AMERICAN SOCIETY FOR TESTING MATERIALS

BULLETIN

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"Promotion of Knowledge of Materials of Engineering and Standardization of Specifications and Methods of Testing"

TELEPHONE—PENnypacker 3545 CABLE ADDRESS—TESTING

Number 87 August, 1937

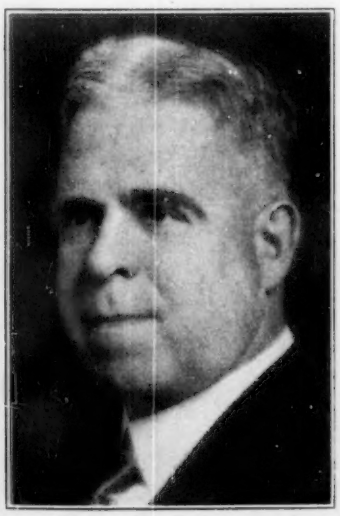
Record-Breaking Attendance at 1937 Annual Meeting

Many Interesting Sessions; Important Accomplishments

THE Fortieth Annual Meeting of the Society held at The Waldorf-Astoria, New York City, June 28 to July 2, was marked by the heaviest registration of members, committee members and visitors of any meeting, totaling 1523. Another record was the large number of proposed standards accepted for publication as new tentative standards, this figure, 51, exceeding that of any other annual meeting. It is an indication of the intensive work which the committees have had under way during the past year. The Society's Fourth Exhibit of Testing Apparatus and Related Equipment, described in a separate article in this BULLETIN, was the most extensive yet sponsored.

A number of the technical papers and reports presented in the 19 formal sessions were intensely interesting, some of them of outstanding significance. There was a heavy attendance at the Formal Opening Session on Monday and at the Marburg Lecture on Wednesday. In addition to the Symposiums on Consistency, on Significance of Tests of Coal, and on Correlation Between Accelerated Laboratory Tests and Service Tests on Protective and Decorative Coatings, there was a strong program of papers devoted to bituminous materials. Other groups of interesting papers involved fatigue and effect of temperature, cast iron and cement and concrete. During the week of the meeting, there were 198 committee meetings, this figure comparing with 180 in the previous year. A statement of some of the important current committee standardization activities appears in this BULLETIN and in the October issue it is planned to outline some of the important research projects—especially the more recently inaugurated ones.

In addition to the nineteen formal sessions, there were several round-table discussions, one on precision and accuracy, another on impact testing and a very well attended one on the physical basis of metallic properties, this latter being sponsored by the American Institute of Physics at the invitation of representatives from other societies.



New President,
A. E. WHITE

Contents

New Vice-President
H. H. MORGAN

During the meeting 54 reports were presented by A.S.T.M. standing committees and others which the Society sponsors and there was a total of 57 papers presented. In addition to these six papers dealing with important aspects of committee activities were appended to the reports. Many items on the program were preprinted, and the fact that there were over 1250 pages set in type indicates the volume of material.

The total registration for the week, 1523, included 960 members, 186 committee members, and 377 visitors. The figure of 1523 compares with 1131 in Atlantic City in 1936 and 1451, the previous high in Chicago, in 1931. It is significant that so many visitors were present at the meeting, the New York meeting giving an opportunity for many to attend and become acquainted with the work of the Society. In addition to the formal registration, there were a large number of other visitors and guests many of whom came especially to visit the Exhibit.

ENTERTAINMENT FEATURES

Local arrangements for the meeting were in the charge of a committee consisting of officers of the New York District Committee, headed by Dr. M. F. Skinker, Consolidated Edison Co. of New York, with past-president H. S. Vassar, Public Service Electric and Gas Co., *Honorary Chairman;* W. H. Finkeldey, Singmaster & Breyer, *Vice-Chairman;* and G. O. Hiers, National Lead Co., *Secretary.* Specific phases of the activities were in charge of the following subcommittees:

Ladies Committee—Mrs. William H. Bassett, Jr.
Entertainment Committee—J. R. Townsend, Bell Telephone Labs, Inc.
Program Committee—R. L. Hallett, National Lead Co.
Finance Committee—K. G. Mackenzie, The Texas Company.
Publicity Committee—E. A. Snyder, Socony-Vacuum Oil Co., Inc.
Exhibit Committee—F. M. Farmer, Electrical Testing Labs.
Membership Committee—J. M. Weiss, Weiss & Downs, Inc.

An elaborate program of entertainment for members and their wives and families was arranged, many of the features being complimented through a special fund which had been raised through contributions from organizations in the New York metropolitan area.

The Ladies' Committee, headed by Mrs. Bassett, had arranged a very interesting program for the ladies including several trips and a bridge-luncheon. A great many of the members participated in the program, especially the trip to Hayden Planetarium on Thursday evening at which there was a special address on the Peruvian eclipse expedition, which had just returned, by Doctor Barton, member of the expedition, and also a lecture on the planetarium itself.

All of the features of the meeting went off smoothly for which the local Committee on Arrangements should receive full credit.

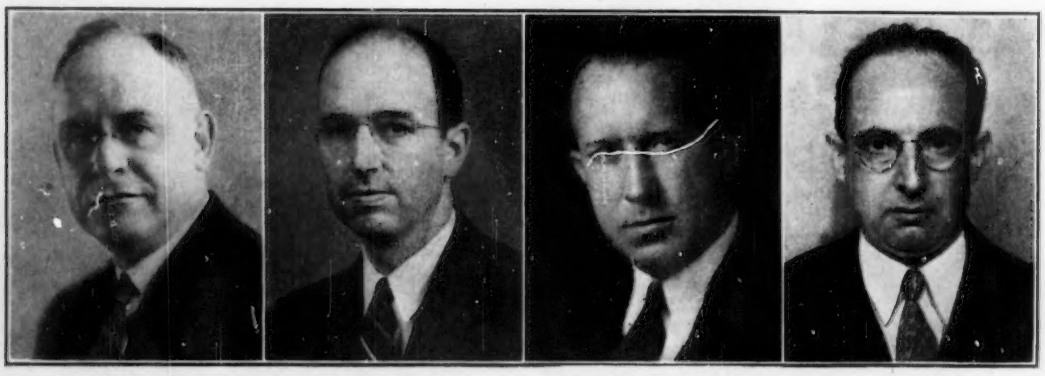
FUELS OF TODAY AND TOMORROW

The first session was featured by the annual address of the President, A. C. Fieldner, on the subject "Fuels of Today and Tomorrow," and honorary memberships were awarded to J. A. Capp, Engineer of Materials, General Electric Co.; G. H. Clamer, President and General Manager, The Ajax Metal Co.; and G. W. Thompson, Chief Chemist and Director, National Lead Co.

Doctor Fieldner discussed the rise of petroleum, covering such topics as the search for oil, improvement of production, developments in refining petroleum and the displacement of coal by fuel oil. In outlining the rise of natural gas, he indicated that next to petroleum the most striking development of our bountiful fuel supply is the utilization of natural gas. He next covered coal production and utilization and then detailed the present-day fuel supply and demand. In trillions of B.t.u's, the total energy supplied from mineral fuels increased from 14,000 in 1907 to 24,600 in 1929, and after a depression drop, the figure in 1936 was raised to 21,878. Industry and public utility power consumed 45 per cent, transportation about a third, and domestic and miscellaneous uses one-fourth of our energy supply. Coal constituted 84 per cent of the fuel for domestic and miscellaneous purposes, 73 per cent for industrial use and public-utility power, and 57 per cent for transportation; petroleum provided 43 per cent of transportation fuel, including almost 100 per cent of road vehicles and airplane fuel, 73 per cent of marine fuel, and 11 per cent of railroad fuel. Natural gas comprised 16 per cent of industrial and public-utility fuel consumption and 7 per cent of the domestic and miscellaneous needs. Since 1929, 7 per cent of the total energy demand has been transferred from anthracite and bituminous coal to petroleum, natural gas, and water power.

After outlining the national fuel reserves, he discussed fuels of tomorrow, indicating that gas, oil and coal are available today in abundance. There is coal enough for hundreds, and possibly thousands of years; but natural gas and oil obtainable by present methods may be exhausted in less than 100 years, and a shortage of our domestic supply may begin within 10 or 20 years.

Officers of New York Committee on Arrangements



H. S. Vassar | M. F. Skinker | W. H. Finkeldey | G. O. Hiers

He indicated that coal will continue to be the principal fuel used for the generation of public utility and major industrial power. Technologic improvements and new hydroelectric power will tend to reduce the consumption of coal; on the other hand, an increasing demand for energy and a decreasing supply of cheap residual oil will increase the amount of coal consumed for power purposes. No material change is expected in either direction in the near future, but in 10 or 15 years the trend will favor increased consumption of coal. Tomorrow's power and central heating plant will burn any kind of coal completely and efficiently.

The convenience and uniformity of automatic heating of homes with gas or oil will continue to attract more users, even at higher costs than those prevailing today. The insulation of houses has been improved greatly, and future homes will permit higher unit cost of fuel without increasing the total heating bill.

Referring to railroad and marine fuels he indicated that further improvements in the over-all efficiency of the steam locomotive and a gradual increase of electrification will retain the use of coal for freight traffic throughout the age of oil and natural gas and that the convenience and economy of Diesel-engine drive for ships and boats is such that its use will continue even after declining production of petroleum requires the production of Diesel fuel from shale or coal.

In discussing the motor fuel supply, he pointed to the prediction of Snider and Brooks that by 1945 there was the probability of considerable shortage of domestic petroleum. Doctor Fieldner said that from the very beginning of the automobile industry, recurring threats of shortage of gasoline were met—in the field, by finding new pools and improving production tecnique; and in the refinery, by increasing yields and making a more efficient product. "The end has not been reached. We are just beginning to use scientific methods in extracting oil from the sands, and catalytic polymerization and hydrogenation eventually will furnish the means for complete conversion of volatile liquids and heavy petroleum to gasoline."

MARBURG LECTURE ON PLASTICS

A capacity audience greeted Dr. T. Smith Taylor when he presented the Twelfth Edgar Marburg Lecture on the subject: "Plastics: Some Applications and Methods of Testing." The attendance at this session was larger than for any other in the Society's history. Doctor Taylor outlined the materials which are considered to be plastics, touching on natural and synthetic plastics, kinds of plastics as to effects of heat, and then described plastic materials and their properties touching on rubber, shellac, cold-molded plastics, cellulose plastics and others, including phenolformaldehyde, cast phenolics, urea-formaldehyde, furfuralphenol resins, vinyl resins, acrylic resins, cumarone resins, polystyrene plastics and casein plastics. He outlined some of the applications and then discussed testing of plastics.

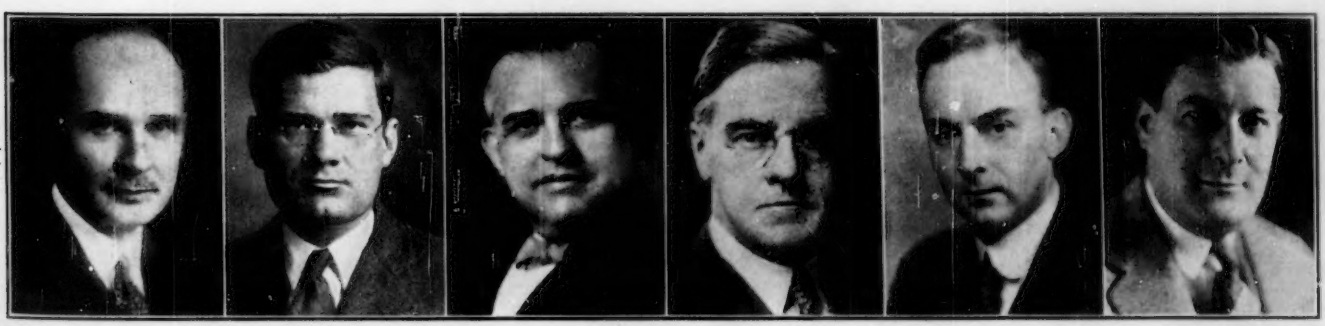
In closing Doctor Taylor discussed significance of tests pointing out that "We are all interested in being able to obtain as nearly an accurate value of the physical and chemical properties as possible. We wish to know what is the proper value to be ascribed to a given property of a material. Having once established this, then the question arises as to just what do the results signify to us as consumers and as producers. In some respects they will mean the same to both consumer and producer. In others the test results may be used quite differently. Thus the producer can use the results of his tests to guide him in maintaining uniformity in his product. He can use the results for determining the uniformity and constancy in his raw materials used, for determining whether his processes are sufficiently controlled, for determining the relative merits of different raw materials, for determining the suitability of his product for specific uses, and for the improvement of both processes and products. The consumer on the other hand needs to know the various properties of the articles he is purchasing in order that he may be sure they will meet the requirements placed upon them in service: that he may know whether the article will function properly in a given application, that he may be guided in substituting a so-called cheaper or better article for one now in use which has proven satisfactory. An intelligent interpretation of test results on the part of both consumer and producer, will result in improved products, cheaper products, and more satisfactory functioning of equipment and apparatus in which they are used.

"While this discussion has only touched upon a few of the phases of plastics and their applications, it is evident that plastics and plastic compounds occupy a very important place in our everyday life and promise through continued research to be of ever increasing value to our civilization."

DUDLEY MEDAL AWARDED

The 1937 Award of the Charles B. Dudley Medal was made to W. H. Swanger and G. F. Wohlgemuth, Senior Metallurgist and Associate Metallurgist, respectively, Na-

Chairmen of Subcommittees on Arrangements



R. L. Hallett J. R. Townsend E. A. Snyder F. M. Farmer K. G. Mackenzie J. M. Weiss

Seated, from left to right: G. F. Wohlgemuth, Dudley Medalist; Past-President A. C. Fieldner; T. Smith Taylor, Marburg Lecturer; W. H. Swanger, Dudley Medalist. Standing: R. E. Hess, Assistant Secretary; President A. E. White and C. L. Warwick, Secretary-Treasurer.

tional Bureau of Standards for their paper presented at the 1936 annual meeting on the subject "Failure of Heat-Treated Steel Wire in Cables of the Mt. Hope, R. I., Suspension Bridge." This paper was considered the outstanding original contribution to research in engineering materials, of those given at the last year's meeting.

Mr. Swanger is a graduate of Pennsylvania State College, 1917. After a short period of employment in the Research Department of the New Jersey Zinc Co., he entered military service for two years, and after further work with the New Jersey Zinc Co. until January, 1921, he became affiliated with the National Bureau of Standards in the Chemistry Division. In 1927 he was transferred to the Division of Metallurgy. His work has involved platinum metals, thermal conductivity of metals, fatigue testing, and investigations of failures of metals. In addition to his membership in A.S.T.M., he is a member of the American Society for Metals and is chairman of the Washington Chapter, A.S.M., 1937-1938.

Mr. Wohlgemuth was graduated from St. John's College, Annapolis, Md., 1919, and until May, 1930, was employed at the U. S. Naval Engineering Experiment Station, associate metallurgist from 1923 until 1930, when he became associate metallurgist at the National Bureau of Standards, where he continued his work in the physical and metallurgical properties of metals and investigations of metals failures. He is a Captain in the Chemical Warfare Service Reserve, U.S.A. In June, 1936, he received his M.S. degree, in course, from the American University in Washington.

STANDARDIZATION ACCOMPLISHMENTS

A large number of recommendations involving new standards and existing specifications and tests were approved at the annual meeting on the request of various standing committees in charge. The number of new specifications approved for publication as tentative was the largest of any annual meeting—51. The number of new tentative standards is one of the indices by which standardization activities of the Society can be judged. The annual meeting approved for submission to letter ballot of the Society for adoption as standard 21 existing tentative specifications and test methods and also the adoption of revisions of 25 standard specifications and tests. The accompanying table summarizes the various actions according to the general materials fields involved.

A list of new tentative standards appears on another page of this BULLETIN. In a separate mailing there is being sent to each member a letter ballot covering the various actions on standards, this being accompanied by a Summary of Proceedings giving detailed information on the matters covered in the ballot.

GOLF TOURNAMENT

There was a good turnout of members for the 1937 A.S.T.M. Golf Tournament held on Thursday afternoon, July 1, at the Crescent Athletic Club, Huntington, L. I., this tournament being in the charge of a committee headed by R. L. Hallett. For the second successive year, C. M. Loeb, Jr., turned in the low gross score winning possession for another year of the A.S.T.M. championship cup. He was also awarded a zipper bag. W. M. Kinney turned in a low net score and received a silver cup. The prize for second low gross was won by V. A. Crosby, second low net by M. Rea Paul and low putts by T. R. Galloway, each of these winners receiving six golf balls. The kickers handicap was won by F. E. Richart, who received a zipper bag, and the visitors' prize was won by F. E. Richart, Jr. The gross scores ranged from 71 to 116 (this latter "distinction" shared by two members). There were several scores in the 80's and low 90's.

FERROUS METALS

Three technical papers and reports of five A.S.T.M. Committees, including the final report of the Research Committee on Yield Point of Structural Steel comprised the session devoted to steel, wrought iron and metallography.

Seven new tentative specifications, prepared by Committee A-1 on Steel, were approved, four of these covering various types of alloy steel plates for boilers and other pressure vessels, two for intermediate alloy steel still tubes and heat exchanger tubes and the other covers iron and steel filler metal. This latter specification was developed in cooperation with the American Welding Society. It provides for seven groups of filler metal classified in accordance with the weld produced. Additional requirements of an optional nature are provided for use when the purchaser desires to test filler metal in a more complete manner. These additional requirements include tension test of welded joint, nick-break test, free-bend tests, usability test and density determinations.

In its final report the Research Committee on Yield Point of Structural Steel made certain recommendations, including one that the speed requirement for the determination of the yield point based on the speed of head running free be discarded and that in the vicinity of the yield point the rate of pulling shall be limited by rates of strain or by rates of stress. Tentatively for wedge grips and an 8-in. gage length the suggested maximum limit for the rate of strain in the vicinity of the yield point is 0.0015 in. per min., which would correspond to a stress limit of 45,000 lb. per sq. in. per min. The committee indicated that the drop of beam or halt in motion of the pointer on the dial are

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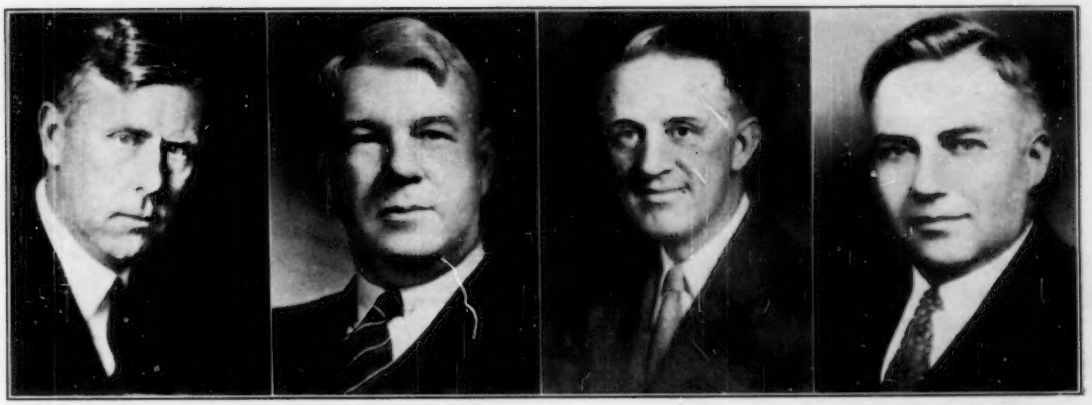


G. E. F. Lundell H. C. Mougey H. F. Clemmer R. L. Templin

NEW OFFICERS

THE recent election of officers, as announced at the annual meeting by the tellers, Prof. H. F. Moore and J. J. Kanter, resulted in the unanimous election of A. E. White as President (1937-1938), H. H. Morgan as Vice-President (1937-1939) and the following as members of the Executive Committee (1937-1939): P. H. Bates, H. F. Clemmer, G. E. F. Lundell, H. C. Mougey, and R. L. Templin.

PRESIDENT

A. E. White, the new President, is Professor of Metallurgical Engineering, and Director, Department of Engineering Research, University of Michigan, Ann Arbor, Mich. Following his graduation from Brown University, 1907, and a year of study at Harvard, 1908, Doctor White was in charge of research on blast-furnace by-products, ores, etc., for Jones & Laughlin Steel Co. In 1911 he became instructor at the University of Michigan, assistant professor 1913-1917. He has held his present positions since 1919. From 1917 to 1919 he served in the Ordnance Department, U. S. A.—was head of the Metallurgical Branch, Inspection Division and also head of the Metallurgical Branch Technical Staff. Dr. White is active in the work of several A.S.T.M. committees. He was the first president of the American Society for Metals and is a past-chairman of the research committee, American Society of Mechanical Engineers. In 1925 Brown University awarded him the honorary degree of Doctor of Science. From 1933 to 1935 he was a member of the A.S.T.M. Executive Committee and completed a term as Vice-President, 1935 to 1937.

VICE-PRESIDENT

H. H. Morgan, newly elected Vice-President, is Manager, Rail and Track Fastenings Dept., Robert W. Hunt Co., Chicago, Ill. He is a graduate of Lewis Institute, receiving his degree of Mechanical Engineer in 1904. He became associated with the Robert W. Hunt Co. and was in charge of miscellaneous inspection, 1907 to 1912; Manager Physical Testing Laboratories, 1910-1917; Manager of Cement Testing Laboratories, 1912-1917. He was representative of the Robert W. Hunt Co. in Washington, War Materials Inspection for Engineer Corps, U. S. A., 1917-1918. He then became Manager of the Pittsburgh Office and District, of his company, and since 1928 has been in his present position. He has been active in numerous phases of A.S.T.M. work, and has been chairman of Committee A-1 on Steel since 1932. He was a member of the A.S.T.M. Executive Committee, 1935 to 1937.

MEMBERS OF EXECUTIVE COMMITTEE

P. H. Bates, Chief, Clay and Silicate Products Division, National Bureau of Standards, Washington, D. C., was graduated from the University of Pennsylvania in 1902. He was Assistant Chemist, Pennsylvania Railroad until 1906, then became Chemist, Technologic Branch, U. S. Geological Survey, at St. Louis, and from 1910 to 1919 was in charge of the Pittsburgh Branch of the National Bureau of Standards. During the next two years he was Chief, Structural Miscellaneous Materials Division, at the Bureau and also Acting Chief, Ceramic Division. He has been in his present position since 1921. Mr. Bates has been chairman of A.S.T.M. Committee C-1 on Cement since 1926 and has been active in other Society work. He is a past-president of the American Concrete Institute.

H. F. Clemmer, Engineer of Materials, District of Columbia, Washington, D. C., is a graduate of Iowa State College, 1912, with the degree B.S. in C.E. He received his professional degree in C.E. in 1917. He was on the Engineering Staff at Iowa for four years, serving as Engineer of Tests for the Engineering Experiment Station and from 1917 to 1920 was Assistant Professor of Civil Engineering, becoming Engineer of Materials for the Illinois Highway Department, 1920-1926, and then until 1930, was Technical Advisor to the Sales Department, Solvay Process Co. Mr. Clemmer was chairman of A.S.T.M. Committee D-4 on Road and Paving Materials for a number of years and is now serving as secretary of Committee D-18 on Soils for Engineering Purposes.

G. E. F. Lundell, Assistant Chief, Chemistry Division, National Bureau of Standards, Washington, D. C., received his A.B. degree from Cornell University, 1903, and Ph.D. degree in 1909. He was Instructor in Chemistry, Northwestern University and then Instructor and Assistant Professor, Cornell, 1906-1917. Then, until 1936, he was Chemist, National Bureau of Standards. He is in charge of the analysis of ores, rocks, ceramic and metallurgical materials, and of the preparation and analysis of the Bureau's standard analyzed samples. He is a member of numerous A.S.T.M. committees and at present is chairman of Committee E-3 on Chemical Analysis of Metals. He is active in the work of the American Chemical Society and the American Ceramic Society.

H. C. Mougey, Chief Chemist and Assistant Technical Director, Research Laboratories Div., General Motors Corp., Detroit, Mich., received his degree of B.S. in Chemical Engineering from Ohio State University in 1911. He was affiliated with the Lowe Brothers Paint Co., Dayton, Ohio, until June, 1917. Then until 1920 he was with the Dayton Metal Products Co., Research Division, and from 1920 to 1925 was with the General Motors Research Corp., Dayton. Since 1925 he has been in the Research Laboratories Division, at Detroit. In 1935 he received the professional engineering degree of Chemical Engineer from Ohio State University. He has been particularly active in the Society in the work of Committee D-2 on Petroleum Products and Lubricants and for several years has been chairman of Technical Committee B on Motor Oils.

R. L. Templin, Chief Engineer of Tests, Aluminum Company of America, New Kensington, Pa., is a graduate of the University of Kansas, 1915, degree of B.S. in Civil Engineering. He was Research Fellow, Engineering Experiment Station, University of Illinois, 1915-1917, and received his degree of Master of Science in Theoretical and Applied Mechanics there. He was awarded the professional degree of Mechanical Engineer, University of Kansas, 1926. Following his work at Illinois, he was at the National Bureau of Standards in Washington until 1919, when he was appointed to his present position. Mr. Templin is the author of a large number of technical papers on materials testing methods and in 1934 was awarded the Charles B. Dudley Medal for his paper on "The Fatigue Properties of Light Metals and Alloys."

Record-Breaking Annual Meeting

(Continued from page 4)

sufficiently accurate methods of determining the yield point in practically all cases.

In a paper on "Weld Metal as an Engineering Material and Some Methods of Testing," it was pointed out that the status of weld metal as an engineering material has changed greatly in recent years. Although the weight of the weld compared to the weight of the other material used in any structure is almost insignificant, the quality of the weld metal is just as vital to the success and safety of the structure as the quality of the material welded. For the determination of the properties of weld metal it has been necessary to supplement routine testing methods with special physical tests, chemical analyses, and metallurgical examinations. As a result of these investigations the behavior of weld metal has been explained and they show that the quality of weld metal is not dependent upon some mysterious circumstances but is the result of welding technique and procedures which can be controlled.

H. C. Mann, Watertown Arsenal, who is continuing studies on impact testing, reported on "A Fundamental Study of the Design of Impact Test Specimens," in which he discussed the length and form of notch on the energy values obtained from the tension-impact test. From data presented he indicated that between certain limits of length of notch the energy per unit volume is a constant, and that when the notch length is reduced, extreme values of energy concentration are obtained.

One session of the meeting was devoted to the subject of cast iron with three reports and four technical papers. The authors of the paper on "A Study of the Effect of Span on the Transverse Test Results for Cast Iron" concluded as a result of an extensive series of tests that the modulus of rupture increased with decreasing span and modulus of elasticity decreases with decreasing span. While deflection decreases with decreasing span, the decrease is much less than the conventional beam formula would indicate.

Two charts for a metallographic system of classification of graphite phase and gray cast iron were presented, one of these identifying graphite flake size similar to the A.S.T.M. grain size chart for steels; the other representing four types of association of graphite flakes differing from each other in their distribution or orientation. A technique for the application of these two charts was proposed in a paper on "A Proposed Standard Classification of Graphite in Gray Cast Iron," with emphasis laid on the use of suitable magnifications in order to produce a record representative of the entire area of the micro-section.

The paper on "The Tensile Strength of Cast Iron" reported tests made to study the influence of surface defects on specimens held in flat and V-notch grips; on threaded-end-specimens, both solid and hollow, to determine the effect of the interior portion on the distribution of stress over the cross-section; and on specimens with ends threaded on the outside and on the inside to study the effect of the location of threads on the strength of the specimen. Strain-gage readings of longitudinal deformation or strain were taken at small increments of load from zero to rupture on six gage lines spaced equally around the circumference of the specimen. Tests were made with both axial and eccentric loads. Among the conclusions were the following:

Different castings made from the same pouring had a variation of 10 to 11 per cent. The material throughout

SUMMARY OF ACTIONS TAKEN AT ANNUAL MEETING AFFECTING STANDARDS AND TENTATIVE STANDARDS

	Existing Tentative Standards Adopted as Standard	Standards in Which Revisions Will Be Adopted	Proposed Standards Approved for Publication as Tentative	Proposed Revisions of Existing Standards Accepted as Tentative	Tentative Standards Revised	Total Standards Adopted	Total Tentative Standards
A. Ferrous Metals—Steel, Cast Iron, Wrought Iron, Alloys, etc	6	..	9	12	3	114	53
B. Non-Ferrous Metals—Copper, Zinc, Lead, Aluminum, Alloys, etc	..	3	3	1	8	57	48
C. Cement, Lime, Gypsum, Concrete and Clay Products	5	5	9	4	5	88	39
D. Paints, Petroleum Products, Coal, Textiles, Rubber, Soap, etc	10	17	30	12	30	242	157
E. Miscellaneous Subjects, Testing, etc	..	..	..	..	..	14	13
Total	21	25	51	29	46	515	310

the length of each casting was fairly uniform, the bottom being stronger than the top by a maximum of 7 to 8 per cent. Hollow and solid specimens had nearly the same strength, with the solid 2 to 5 per cent stronger. In each of these types there was little difference on the outside and those in the inside. Surface finish is not particularly important in tension.

NON-FERROUS METALS

Committee B-2 on Non-Ferrous Metals and Alloys submitted new tentative specifications for rolled zinc which are in effect revisions of the previous standard (B 69), which they supersede. The adoption of a revision of the Standard Specifications for Slab Zinc (Spelter) (B 6 - 33) was approved for reference to Society letter ballot. The major change provides for zinc of extreme purity as grade (1a) and the specifications were brought into conformity with present-day practice.

Committee B-5 on Copper and Copper Alloys developed new Tentative Specifications for Copper and Copper-Alloy Seamless Condenser Tubes and Ferrule Stock, the specifications combining in a single standard requirements for the various alloys manufactured in the form of seamless tubes for use in surface condensers, evaporators and heat exchangers, including admiralty metal, Muntz metal, and copper-nickel alloy. The existing standard and tentative specifications covering these alloys were therefore withdrawn.

In the paper on "Fatigue Properties of Non-Ferrous Sheet Metals" results were given of fatigue tests on nine alpha-brass alloys, one nickel-silver alloy, two phosphor-bronze alloys, three beryllium-copper alloys, one copper-nickel-silicide alloy, copper, Everdur, nickel, three nickel alloys and three aluminum alloys. The data show that nickel silver sheet of 0.015 to 0.017-mm. average grain size has a higher endurance limit than similar material of larger grain size. The data also confirm earlier conclusions that dispersion hardening of alpha brass by the addition of nickel silicide increases the endurance limit and that cold work raises the endurance limit but not proportionally to the increase in tensile strength. Age hardening markedly increases the endurance limit of type K monel metal, aluminum alloy 17S and beryllium-copper alloys. The ratio of endurance limit to tensile strength for the alloys investigated varies from 0.136 to 0.403, depending upon composition, heat treatment and amount of cold work. The highest endurance limits were observed for nickel and alloys of high nickel content. Little difference was observed between the endurance limits for heat-treated copper-base alloys such as beryllium copper and cold-worked alloy C phosphor bronze.

Two interesting papers were a part of the report of Committee B-6 on Die Cast Metals and Alloys—one "A Study of Die Design Changes for the Improvement of the Soundness and Uniformity of Test Bars" and another on "Brass Die Castings." This latter paper outlined some of the early problems and discussed the casting cycle. The author covered the applications of brass die castings and gave a detailed discussion of die steels. He also covered the alloys and alloying practice.

Appended to the Report of Committee B-7 on Light Metals and Alloys was a discussion on Methods of Testing Oxide Coatings on Aluminum, giving data and information which have been developed by a special subgroup. The report deals with methods available for measuring the properties of thickness, abrasion resistance, and electrical breakdown voltage of oxide coatings on aluminum and, of course, further experience with the methods presented will be necessary before standardized conditions of operation can be established and the accuracy of the methods adequately appraised.

FATIGUE AND EFFECT OF TEMPERATURE

In the report of the Committee on Effect of Temperature the enlargement of the program of sponsored researches was detailed, and information on reorganization of the committee was given. Upwards of $20,000 has been raised to carry on the extensive research program—a number of companies interested in the work having contributed. A progress report on long-time creep tests of 18 per cent chromium, 8 per cent nickel steel and 0.35 per cent carbon steel was presented. The appended paper on "Discrepancies in the Load-Carrying Abilities of Carbon Steels at 850 F." pointed out that there are differences in steels that are huge from the point of view of load carrying ability at high temperatures. While greater refinement in methods of creep testing and more knowledge of the effect of multi-dimensional stress and the like in high-temperature problems are needed, attention should not be confined to such matters to the neglect of the steel-making variables that produce a ten-fold variation in creep behavior of killed and rimmed steels, it was stated.

"A Comparison of the Methods Used for Interpreting Creep Test Data" pointed out that there may be considerable difference in the working stresses as obtained by different methods of interpretation. The McVetty method, Bailey method, log-log and the log method were discussed.

A creep testing machine which provides from 12 to 60 tests at different stresses in the same furnace was described. The apparatus is designed to meet the fundamental requirements of similar test specimens, constant stress, constant and uniform temperature, and means of creep measurement suited to the purpose of the tests.

The paper on "Relaxation of Copper at Normal and at Elevated Temperatures" pointed out that relaxation, a manifestation of creep, is beginning to attract more attention. Relaxation is exhibited when a material is stretched to and then held at a given extension; creep immediately begins to take place, and this tendency to elongate causes the stress to decrease. The paper furnishes information upon the interdependence of such factors as stress, temperature, time, and the amount of cold work. It indicated that a marked increase in relaxation takes place when the temperature is raised above about 80 C. At 200 C. the stress is estimated to fall to about 20 to 25 per cent of its initial value in a service time of 20 years. The dissimilarity between the speed laws for decreasing and for increasing stress gives rise to rather large amounts of relaxation.

Of the two papers on fatigue, one described a machine for testing metals at elevated temperatures. The specimen is part of a cantilever beam, one end of which is fixed in the electrically heated furnace. From the load-deflection relationship thus obtained, the stress in the test specimen can be calculated. The temperature from room to 1100 F. can

(Continued on pages 37 to 42)

Three Honorary Memberships Awarded

Messrs. Capp, Clamer and Thompson Honored at Meeting

One of the interesting events at the annual meeting was the award of Honorary Memberships to three men, J. A. Capp, G. H. Clamer and G. W. Thompson who for long periods of time have been extremely active in the work of the Society. The memberships were awarded by Doctor Fieldner in the formal opening session of the meeting. Honorary members are elected by unanimous vote of the Executive Committee. The closing paragraph of the citations for the three men were similar in each case: namely,

"We believe that his attainments as briefly set forth above show him to be a person of widely recognized eminence in the field of the Society's activities and that election to Honorary Membership will be a fitting recognition of these attainments and of the great service that he has rendered to our Society."

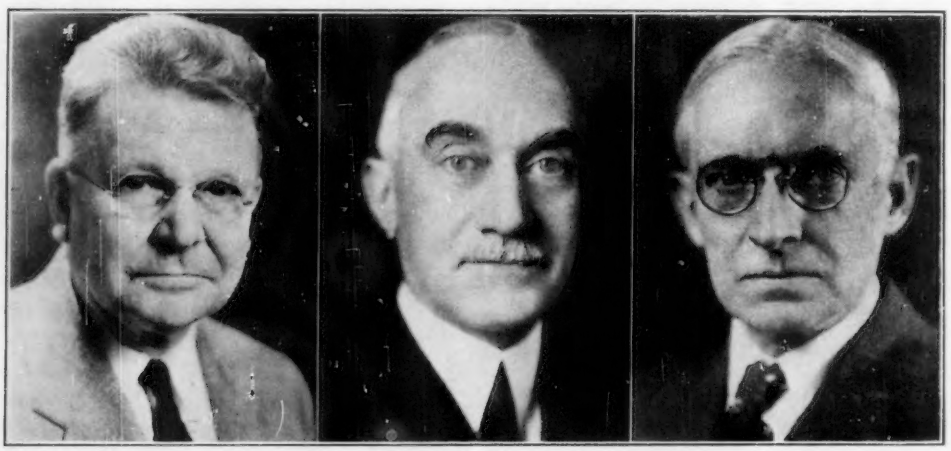
J. A. Capp

Mr. Capp was presented to Doctor Fieldner by Mr. N. L. Mochel, who reported the citation. He also stated that to him Mr. Capp symbolized two important opportunities offered by the A.S.T.M. He said "here is where the young, raw, untried man may sit down with men of experience. Here, the representatives of competing interests may brush aside the hard dividing lines decreed by competition, and while retaining the natural restrictions, delicacies and courtesies of their situations, may discuss together their mutual problems and plans. I know that I voice the thoughts of many of you, in testifying to the kindly manner in which Mr. Capp has received young men and inspired them to follow those high ideals that he has always followed."

In his response Mr. Capp indicated that he felt the honor was not an acknowledgment of some outstanding object accomplished all at once, but must be in recognition of a more long-continued effort. He expressed his opinion that those privileged to take an active part in Society affairs were really going through an advanced course in engineering. "First, there is the course of the materials of engineering. Nowhere is there available to that participant the vast fund of information, technical knowledge of materials, that is available to the man who gives and takes in committee activities. That information is not published in the textbooks. Much of it does not even appear in our *Proceedings*. It is the result of personal contact in giving as well as taking in committee activities. That is an important course, but more important is the opportunity to take a course in human engineering, in which we learn to deal with others in a human way. Mr. Mochel has spoken of the conflict, sometimes, of producer and consumer interests. He might have spoken of the strong opinions which an engineer is liable to form, of the perhaps undue adherence to those opinions, the failure to realize that somebody else's opinion may be worth just as much as his, perhaps more. Nowhere does that sort of give and take, as a necessity, appear as it does to the student of human engineering in the A.S.T.M. committee activities. The man who goes to any committee in that right spirit can nearly always accomplish anything, not that he wants, but that he ought to have. There may be quite a big difference, but the most interesting part of these two courses that we take is the fact that there is no formal curriculum, there are no professors, there are no examinations except the test of endurance, there are no degrees awarded nor diplomas, nor, in fact, do we graduate. There can be no job more worth while to the young engineer than to enroll in those two courses, even though he may feel that there is nothing particularly ahead for him. There is a great deal; he can serve the Society by helping it cooperatively, but if nothing else, think of the tremendous gain to himself. That is worth his while to strive for, but it is interesting that, while our Society does not confer degrees, does not give diplomas, it does, once in a while, feel that some sort of a reward for effort might be worth while, an acknowledgment or evidence of an endeavor to do the job that you have laid your hands to, and, Mr. President, it is in that spirit that I welcome and am grateful for the acknowledgment you have given me in this Honorary Membership."

Biographical Sketch

Mr. Capp has spent his entire engineering life with the General Electric Co., with whom he went in 1892 upon graduating from the University of Pennsylvania. In those forty-five years he has specialized in the study of the many types of materials entering into the construction of electrical machinery, and for many years has headed the Works Laboratory of his company as Engineer of Materials. While much of his work has been done in the metals field,



J. A. Capp G. H. Clamer G. W. Thompson

he has made many contributions to the non-metals field, notably in petroleum products and electrical insulating materials.

His contributions to the work of the American Society for Testing Materials are many. A member since 1898—the date of organization of the American Section of the International Association for Testing Materials—he has served as a member of some eighteen committees, either in his personal capacity or as representative of his company. Perhaps his outstanding work has been as chairman since its organization in 1909 of Committee B-1 on Copper and Copper Alloy Wires for Electrical Conductors,—then Committee W on Copper Wire—where his expert knowledge of tests and properties of non-ferrous wire products and his organizing and executive abilities have contributed to the development of specifications and methods that have for years been the standards of that industry. He has long been active in Committee A-1 on Steel, heading up various subcommittees and serving as vice-chairman 1913 to 1917 and chairman 1918. In 1920, the important task of reorganizing Committee E-1 on Methods of Testing was placed in his able hands and he continued as chairman until 1927.

In 1917 he was elected to the Executive Committee of the Society and after serving for two years, was elected President in 1919. Here he served our Society ably. At that time, he was appointed (together with Edgar Marburg and A. A. Stevenson) to develop with representatives of other societies the plans for organizing the American Engineering Standards Committee, now the American Standards Association. Mr. Capp has served continuously since 1918 as an A.S.T.M. representative in that organization.

G. H. CLAMER

Doctor Clamer was presented to the President and his citation given by Mr. W. R. Webster. He pointed out that one of the extremely important contributions of Doctor Clamer was his interest in the possibilities of the electric melting of non-ferrous metals and that as a result of his achievements in this one field reductions in cost and improvement in quality which had been brought about by developments by Doctor Clamer run into enormous figures yearly. Doctor Clamer in his response expressed his appreciation, mentioned that there had been only three Honorary Members and that the only one living was Doctor Talbot, University of Illinois. He referred to his close contacts with Mr. Capp and Doctor Thompson, having met the latter at the annual meeting at Delaware Water Gap in 1903. He mentioned that his long years of association with A.S.T.M. had been delightful, interesting and profitable ones and that he would not have exchanged anything for them.

Biographical Sketch

Mr. Clamer is a graduate of the University of Pennsylvania, receiving his bachelor's degree in Chemistry in 1897. In that year he went with the Ajax Metal Co., establishing one of the first chemical laboratories in the non-ferrous metals industry. He has been associated with this company since that time and is now its President and General Manager. He did much pioneer work in the chemical phases of the non-ferrous industry and has to his credit a number of inventions, including a refining process employing scrap metals for which he received in 1901 the Elliot Cresson Gold Medal of the Franklin Institute. His outstanding achievements in the metal casting industry were recognized in 1933 by the award of the Joseph S. Seaman Gold Medal of the American Foundrymen's Association.

For many years he has been engaged in the development of electric induction furnaces and is one of the recognized leaders in that field. This has led to improved methods of melting metals with consequent improved quality and closer control of constituents of alloys. He is President of the Ajax Electric Furnace Corporation and of allied companies engaged in this work.

In the A.S.T.M., of which he has been a member since 1902, he has been most active. He is one of the earliest members from the non-ferrous industry and has been engaged in many phases of the Society's work dealing with the products of that industry. He is especially active in the work of Committee B-2 on Non-Ferrous Metals and Alloys, having been a member of that committee since its organization in 1909, and taking a responsible part in much of its work. He is also active in the work of Committee B-5 on Copper and Copper Alloys, Cast and Wrought.

In 1918 he was elected President of the Society and in this and other ways has helped to guide the destinies of the Society.

His technical and scientific activities have not been confined to the work of our own Society. He is a charter member of the American Electro-Chemical Society, one of the original American members of the British Institute of Metals, and a past-president of the American Foundrymen's Association. For many years he has taken a keen interest in the work of the Franklin Institute, of which he is a Director. In 1933 he was given the honorary degree of Doctor of Science by Ursinus College.

G. W. THOMPSON

In presenting Doctor Thompson and reading his citation, Mr. C. S. Reeve expressed pleasure at the honor and privilege of doing so. He referred to Doctor Thompson's valuable work in the Society and the fact that he was an international authority on lead and its uses. In expressing his gratitude, Doctor Thompson indicated why he so highly appreciated the honor given him. He mentioned that the world grows in many different ways, there are revolutions, inventions that are revolutionary, and manufacturing processes that are developed that have profound effect. He said that to him the A.S.T.M. represented something very high, very dear and very wonderful—an integrating process developing new lines of thought which become knitted together, integrated and a sure foundation for future growth. "There are a great many industries, different, we think, and yet somehow or other tied together, and I think of the earnest work which the members have done, the sacrifices that they have made, and the fact that it is a working Society. It has been a great pleasure to have been associated with it."

Biographical Sketch

Mr. Thompson is an international authority on lead and its uses and has probably done more than any other living man to develop the scientific and technical aspects of the lead industry. The literature contains a large number of his contributions, most of which have related to pigments, linseed oil and non-ferrous metals. He has been Chief Chemist of the National Lead Co. since 1892 and a Director since 1916. He has also been a director and officer of a number of the subsidiaries of that company.

Mr. Thompson's membership in the Society dates from 1903 when he was also elected to membership on Committee D-1 on Paints, Varnishes and Lacquers, then Committee E on Preservative Coatings for Iron and Steel. During the period when he was secretary of that committee, 1910 to 1920, the committee had under way one of the most extensive series of test programs that any A.S.T.M. group has ever undertaken. He was also in charge of extensive work in the development of reliable data and adequate specifications for linseed oil. He has also been a member of Committee E-8 on Nomenclature and Definitions since its organization in 1920. He has contributed a number of papers to the *Proceedings* of the Society dealing with paints and pigments.

He has contributed greatly to the executive direction of the Society's affairs. He served twice as a Member of the Executive Committee, 1912 to 1913 and 1916 to 1918; in 1926 he was elected Vice-President, and became President of the Society in 1928. His advice and counsel in the affairs of the Society have been invaluable.

He has been active in many scientific and technical organizations, including the American Chemical Society, American Institute of Chemical Engineers (of which he was President in 1918), Society of Chemical Industry, and American Association for the Advancement of Science. In 1927 the Armour Institute of Technology conferred on him the honorary degree of Doctor of Science.

Most Extensive Exhibit Held

Interesting Industrial, Research and Committee Displays

THE 1937 Exhibit of Testing Apparatus and Related Equipment, the fourth sponsored by the Society, was held during the five days of the annual meeting, June 28-July 2, at The Waldorf-Astoria, New York City. Three large rooms adjacent to the meeting session rooms were used to provide space for the various displays.

The exhibit was the most extensive that has yet been held, 53 exhibitors using 57 booths. Forty-two companies engaged in the production and distribution of testing and research instruments, laboratory supplies and other products used in connection with materials of engineering participated in the exhibit and there were displays of a research nature sponsored by four organizations—General Electric Research Labs., Consolidated Edison Co. of New York, Inc.—Research Bureau, Polytechnic Institute of Brooklyn, and U. S. Bureau of Mines. In addition to a Society booth, in which there were complete displays of Society publications and other material relating to A.S.T.M. work, six committees had booths.

Many of the apparatus companies displayed for the first time new instruments and equipment, and a number featured important improvements in existing apparatus. The instruments which were shown covered practically all phases of work in which the Society is interested, and gave to those attending the exhibit an idea of the wide range of equipment available for investigating and testing engineering and related materials. The following companies took part in the exhibit:

Ace Glass Incorporated
American Instrument Co., Inc.
Amthor Testing Instrument Co., Inc.
Atlas Electric Devices Co.
Baldwin-Southwark Corp.
Bausch & Lomb Optical Co.
Christian Becker, Inc.
E. E. W. Bowen & Co.
Cambridge Instrument Co., Inc.
Central Scientific Co.
Eimer & Amend
Emerson Apparatus Co.
Federal Pneumatic Systems, Inc.
Federal Products Corp.
General Radio Co.
Great Western Manufacturing Co.
The Emil Greiner Co.
Illinois Testing Laboratories, Inc.
The Instruments Publishing Co.
Leeds & Northrup Co.
E. Leitz, Inc.
"Metals and Alloys"
National Carbon Co., Inc.
Tinius Olsen Testing Machine Co.
Palo-Myers, Inc.
Parr Instrument Co.
Pfaltz & Bauer, Inc.
Philips Metalix Corp.
Podbielniak Industrial Research and Engineering Laboratories
Precision Scientific Co.
Radium Chemical Co., Inc.
Riehle Testing Machine Division, American Machine and Metals, Inc.
George Scherr Co., Inc.
Scientific Glass Apparatus Co.
Henry L. Scott Co.
Shawmut Engineering Co.
The Standard Electric Time Co.
Alfred Suter
C. J. Tagliabue Mfg. Co.
Testing Machines, Inc.
Wilson Mechanical Instrument Co., Inc.
Carl Zeiss, Inc.

COMMITTEE DISPLAYS

Many favorable comments on the Exhibit were made by officers and members of the Society and visitors. Special commendations were given the various committees which took part, these being as follows:

Committee A-5 on Corrosion of Iron and Steel (in cooperation with Committee B-3 on Corrosion of Non-Ferrous Metals and Alloys and other A.S.T.M. committees)
Committee B-7 on Light Metals and Alloys, Cast and Wrought
Committee D-9 on Electrical Insulating Materials
Committee D-13 on Textile Materials
Committee E-4 on Metallography
Joint Research Committee on Effect of Temperature on the Properties of Metals (jointly sponsored by A.S.M.E. and A.S.T.M.)

The display arranged for Committee A-5 by T. R. Galloway, secretary of the committee, featured a large wall map on which was indicated the location of the outdoor corrosion testing stations for metals, both ferrous and non-ferrous, including those of the following committees: A-5, B-3, B-6, D-1 and D-14. This was supplemented by photographs of outdoor test sites showing the racks and specimens, with descriptive material, giving a conception of the scope of the Society's corrosion tests, the duration and their magnitude.

Several placards showing outdoor test specimens of the galvanic couple corrosion tests of Committee B-3 were on display. The immersion test work of A-5 was shown by copper replicas of riveted plates after immersion in seawater and there were a large number of placards with outdoor specimens mounted on them, made up in the form of a large reference volume showing samples of sheets exposed in the total immersion tests. There was a sample test frame used in the recently inaugurated wire tests, with samples of the tags used in marking the various materials in this country-wide program. Committee D-1 contributed two of the 57 steel panels painted with

General Views of Part of the Exhibit

one of the 19 paints used in the Havre de Grace bridge tests.

An extensive display was sponsored by Committee B-7 involving various phases of its work. There were a large number of products in the booth fabricated from various types of alloys standardized by the committee involving both magnesium alloys and aluminum alloys. The display was arranged in sections and included oxide coatings on aluminum, discussed in the annual report and aluminum-base alloy permanent mold castings. Two panels showed ingots of the eleven permanent mold alloys and the twelve alloys covered in the sand castings specifications. Various members of the committee cooperated in furnishing material for the display which was arranged by Sam Tour, chairman of the committee.

A very interesting display was developed by Committee E-4 on Metallography, various members contributing material. J. J. Bowman, secretary of the committee, and W. E. Harvey, a member, arranged the exhibit. Various panels covered methods of detecting austenite grains in steel and a chart showed comparisons of austenite grain size. Photomicrographs of copper and copper alloys were shown and a number of results of X-ray tests. One panel covered a research investigation on the mechanism of freezing in cast iron, and also unequal dendrites in steel. An illuminated display on a method of permanent record titling, showed the steps from the typed stencil of the title through the various phases of development of the film.

The Research Committee on Effect of Temperature had a comprehensive display, with numerous photomicrographs relating to structural stability: effect of temperature, time and stress. Photographs showed various types of creep test equipment in a number of laboratories. The effects of columbium and titanium on the properties of 4-6 chromium steel were shown and a number of large panels with actual test specimens illustrated the research investigations on the effect of low temperatures on aircraft materials. There was a flow chart of tests required for determining the high-temperature characteristics of metals from the hot-rolled bar through the various tests. This also showed methods of plotting creep data. Curves, photographs, etc., were arranged covering the long-time creep tests on the Joint Committee's Steel K-20 and K-19. Dr. R. H. Aborn was in charge of the display, for the Joint Committee.

In its booth, Committee D-9 showed the Victor shellac flow apparatus and the flow testing apparatus developed by the committee, both of these being covered in a new standardized test for the fluidity of shellac. A five-bar mold, proposed as a standard specimen mold for tests of molded insulating materials was displayed and also the power factor cell, purchased from the A.S.T.M. Research Fund for studies of insulating oils. Arc resistance electrodes, under consideration for use in a standard method for determination of surface arc resistance of solid electrical insulating materials were included. Three developments of the Bell Telephone Laboratories—a constant-pressure micrometer caliper; flow machine and plasticity-set mold, all relating to the work of Committee D-9 were in the display.

Various subcommittees and sections sponsored portions of the extensive exhibit of Committee D-13. There was one on wool showing various wool classifications and photographs of wool fibers, determination of fineness of wool, etc.; a panel illustrated breeds of sheep and grades of wool fabrics. The U. S. Department of Agriculture, Bureau of Agricultural Economics, Wool Section, cooperated in this display which was developed and set up by Dr. Werner von Bergen.

The rayon group had a display showing various types of rayon products and demonstrating applications of standards in the charge of the committee. Methods of testing pile floor covering and asbestos and asbestos textiles were covered in the display.

Through the courtesy of the U. S. Department of Agriculture various aspects of fiber length, strength tests, and fiber cross sections of cotton were demonstrated. Samples of various types of cloth tested for color fastness to washing, including cotton, wool, and silk were on display, as were types of materials used in tire construction. The newly organized Subcommittee A-6 on Household and Garment Fabrics which is getting an active program of work under way showed serviceability tests on blanket fabrics.

Dr. D. E. Douty and his staff planned and erected the various divisions of the exhibit for Committee D-13.

International Testing Congress Held

IN PREVIOUS issues of the BULLETIN announcements have appeared concerning the Congress of the International Association for Testing Materials held in London, England, April 19 to 24, 1937, and the fact that of the large number of papers to be presented some 23 were prepared by authors in this country. Several A.S.T.M. members attended the Congress and the Society was officially represented by R. L. Templin, Aluminum Company of America, and W. E. Emley, National Bureau of Standards.

Representatives from 25 of the 31 countries having members in the I.A.T.M. attended the Congress, the total number of those in attendance being about 900. There was much interest in the technical papers presented and the sessions were capably handled by the various chairmen.

The Congress was held under the auspices of a special committee consisting of the British I.A.T.M. Committee and representatives of the leading British institutions. Sir Frank Smith, K.C.B., was chairman of the British Executive Committee in charge of the Congress and Dr. H. J. Gough chairman of the British I.A.T.M. Committee.

One of the actions taken at the Congress was to effect a reorganization—official advice on this is expected in the near future. It was decided to allot the next Congress to Germany and Dr. Ing P. Goerens of Germany was elected president of the association.

During the Congress, there was an exhibition of testing plants and apparatus, several of the exhibits selected from various British laboratories relating to the subject matter of Congress papers. Numerous excursions were arranged, including visits to the Building Research and Paint Research Stations, National Physical Laboratories, Chemical Research Laboratory, Forest Products Research Laboratories and Cambridge University.

The Society's representatives indicated that there seemed to be a definite desire to establish test methods on a uniform international basis and that much interest was shown in the methods developed and adopted by A.S.T.M.

Arrangements for solicitation of papers in the United States and other matters in connection with the American participation were directed by W. H. Fulweiler, American representative on the I.A.T.M. Committee.

The Cement Reference Laboratory[1,2]

By J. R. Dwyer[3]

UNIFORMITY in testing procedure among various laboratories is of such great interest in the work of the Society that it appears quite appropriate to present a brief resumé of the origin and the work of a laboratory unique in the materials testing field and devoted to improvement and standardization of tests. That laboratory is the Cement Reference Laboratory, sponsored by the Society's Committee C-1 on Cement and maintained jointly by the Society and the National Bureau of Standards.

For many years the members of Committee C-1 have actively sought improvement in methods of testing cement and in those endeavors the committee has had the cooperation of two able organizations, the Portland Cement Association and the National Bureau of Standards, both of which were founded at about the same time as the Society. From time to time cement specifications were made more complete with regard to apparatus and method in the effort to attain better agreement in the results of different laboratories. However, the achievement along this line was far from satisfactory and the problem became even more pressing with developments not only in test methods but in the cements themselves. Eventually, following an extensive series of cooperative tests, one of the subcommittees of Committee C-1 reported that the variations among the results of the participating laboratories were so great that any definite recommendations as to the relative merits of test specimens or methods appeared unlikely until some means of training would secure greater uniformity in the operators' work.

Committee C-1 appointed a special committee to seek the establishment of a laboratory which would, through field work and otherwise, afford demonstrations of the proper performance of standard methods, calibrate the testing apparatus and promote uniformity in the tests of cement. The chairman of that committee was the late Frederick W. Kelley, well known for his activities in both the Portland Cement Association and in Committee C-1. Mr. Kelley, who had long been an ardent advocate of the proposed work, was ably assisted by two other well-known members of the Society—Cloyd M. Chapman and the late Richard L. Humphrey. The special committee labored successfully and secured the required funds, one-half as a contribution to the Society and the other half from the Government as an appropriation of funds for the Bureau of Standards.

The new project, named the Cement Reference Laboratory, was soon established at the Bureau, beginning its work in April, 1929. Since then, through the assistance of the Bureau and the continuation of contributions to the Society, the Laboratory has been enabled to work without interruption.

The annual reports of Committee C-1, as published in the Society's *Proceedings,* relate many details of the nature and extent of the Laboratory's activities. However, the project has interested groups other than those dealing with cement and there is, therefore, offered the following general discussion of the Reference Laboratory's activities, with but little reference to the details which might interest cement laboratories only.

PERSONNEL AND FUNDS

The laboratory staff, varying in size from time to time, as circumstances warrant, is made up in part of Government employees and in part of men paid from special A.S.T.M funds. The latter men are classed as Research Associates and work under the regulations governing such Associates at the Bureau. The Bureau furnishes the use of equipment, office and laboratory space, and provides a generous share of the clerical work. The special equipment necessary for the work has been supplied partly from A.S.T.M. funds, but for the most part by the Bureau. Travel costs and miscellaneous expenses are borne by both funds.

WORK OF THE LABORATORY

The Laboratory's work may be approximately classified under five headings: (1) instructions in methods of testing; (2) inspection of apparatus; (3) field inspection of cement testing laboratories; (4) comparative tests; (5) special tests of cement.

INSTRUCTIONS IN STANDARD METHODS OF TEST

Instruction in methods of test is sometimes given to operators who visit the Bureau to receive such help. However, nearly all of the instruction is accomplished as a part of the field inspection service. The inspector witnesses a demonstration by the operator and offers comments on such details as may require correction or merit discussion. Then the inspector himself demonstrates the standard test methods. The more important observations and recommendations are made part of confirmatory reports.

It is difficult to measure and show the benefit of such demonstrations. However, that such inspection of methods has been effective in securing more uniform testing procedure is indicated by various comments of interested laboratory men, correspondence with laboratories, closer agreement in comparative test results than was evident some years ago, and comparisons of the reports of the various inspection tours.

A comparison was made of the details of the test methods observed in the first four tours. Under the principal divisions of procedure were listed the various details and, then, opposite each of these details were shown the percentages of laboratories which had demonstrated that portion of the test in accordance with specification requirements. A detailed presentation of that comparison appears in the report of Committee C-1 for 1935.[4] A general improvement in the methods was observed during the progress of the work. It was also evident in the fourth tour that those laboratories which had received one or more previous inspections adhered more closely to standard practice than those laboratories which were being inspected for the first time.

INSPECTION OF APPARATUS

The inspection of apparatus includes an examination for general condition and detailed tests for compliance with certain specification requirements. Some of the apparatus is

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[1] Publication approved by the Director of the National Bureau of Standards of the U. S. Department of Commerce.

[2] Presented at the Fortieth Annual Meeting, Am. Soc. Testing Mats., New York City, June 28-July 2, 1937.

[3] Research Associate, National Bureau of Standards, Washington, D. C.

[4] *Proceedings,* Am. Soc. Testing Mats., Vol. 35, Part I, p. 238 (1935).

received and tested at the Bureau and for such tests a fee is charged, the money received being gathered into the miscellaneous receipts of the U. S. Treasury. However, nearly all of the tests of apparatus are made in the field, and for the field tests no charge is made.

The inspection of apparatus is chiefly limited to the equipment required for the standard specification tests, but information is gathered and suggestions offered on certain apparatus required by some of the tentative specifications of the Society.

Many of the more decided variations from standard first observed in apparatus were undoubtedly occasioned by the absence of suitable tolerances to indicate how closely a manufacturer of equipment should adhere to specification requirements or how well the laboratory should maintain equipment. Indeed, one of the earliest tasks was the selection of appropriate tolerances by Committee C-1 for insertion in the specifications. When determining these tolerances, and in developing later tolerances, the Reference Laboratory was in a position readily to collect information both from outside sources and from various shops and laboratories within the Bureau. Also, there was available special equipment for making tests to study the effects of variables in apparatus and method of use thereof, such as rate of loading strength specimens, dimensions of setting-time needles, variations in sieves, planeness of cube-mold faces, etc.

The volume of the work attendant on testing the apparatus is illustrated by the figures in Table I. The apparatus inspected during the fifth tour, which is not yet completed, is not included in the table.

The benefit of this periodic inspection of apparatus has been apparent in the improvement in both condition and performance of apparatus observed by the inspectors, and has also been indicated by correspondence and discussions concerning equipment. An attempt has been made to express the change in apparatus quantitatively in Table I. There were some changes of tolerances during the progress of the work, including some leniency regarding briquet molds, but in general the table is quite representative.

INSPECTION OF CEMENT TESTING LABORATORIES

The major part of the Laboratory's activities has consisted in field inspections of the cement testing laboratories. Itineraries are so arranged that inspectors visit interested laboratories at intervals of about two years. Such regular inspection is furnished without charge to the inspected laboratories. Emphasis is placed on the fact that the Reference Laboratory does not endeavor to impose its services, but inspects only when so requested by the officials of the laboratory involved.

The inspection of laboratories includes the tests of apparatus required for the standard cement tests, inspection of test methods, demonstration of tests by the inspector, examination and comments on test specimen storage equipment, determinations of temperature and relative humidity, collection of miscellaneous information. Upon the completion of the inspection, the inspector confers with one of the laboratory's staff, discussing with him the items of interest developed during the visit. Copies of the inspector's reports are sent to the Reference Laboratory.

No attempt is made to rate or certify a laboratory as such, but a confirmatory report is sent to the official who requested the inspection. This report includes a certificate for apparatus which has been found to comply with requirements. The report also includes comments on miscellaneous equipment, unsatisfactory apparatus, the observed demonstration of test methods, results of temperature and relative humidity determinations. Suggestions are offered where feasible.

Copies of these inspection reports have been frequently used as information for officials supervising work performed by the inspected laboratory. For example, the U. S. Bureau of Public Roads has required that laboratories making acceptance tests of cement for Federal Aid projects be inspected by the Reference Laboratory, and that copies of the confirmatory reports of inspection be furnished to that bureau. Decision as to the approval of a cement laboratory for certain work must be made by the supervising official concerned, not by the Reference Laboratory.

All distribution of reports, originals and copies, is made through the Bureau of Standards and copies are issued to other than the inspected laboratory only when proper authorization has been received from that laboratory. The use of these reports by supervising offices has increased during the past year or two and has involved a large number of laboratories—commercial, state highway department, and producer laboratories. These reports have sometimes been the basis upon which supervising offices have required certain very definite improvements in methods and apparatus as requisite for approval.

The laboratories which have participated in this work are very widely scattered geographically and visits have extended into all of the states. The classification of the laboratories with respect to their interests is shown in Table II. When it is remembered that for the majority of the laboratories inspection is not required by any supervising agency, and that their continued participation in the work is volun-

TABLE I.—QUANTITY OF APPARATUS INSPECTED DURING THE FIRST FOUR TOURS AND PERCENTAGE APPROVED

Apparatus	First Tour, 208 Laboratories		Second Tour, 265 Laboratories		Third Tour, 224 Laboratories		Fourth Tour, 143[a] Laboratories	
	Quantity	Per Cent Approved	Quantity	Per Cent Approved	Quantity	Per Cent Approved	Quantity	Per Cent Approved
Steam chests	201	48	250	63	211	78	127	92
Balances for mixes	266	74	347	68	282	86	176	89
Balances for fineness	222	33	260	49	213	76	124	92
Tension testing machines	217	43	260	62	223	80	142	87
Vicat apparatus	251	30	309	51	265	80	166	82
Gillmore needles (pairs)	262	58	317	61	269	89	166	95
Briquet molds	7 764	67	10 643	80	9 188	92	5 338	92
Glass graduates	477	84	594	92	580	94	344	93
Weights for mixes	2 951	97	3 721	93	3 053	98	1 866	99.7
Weights for fineness	1 553	95	2 305	95	2 753	98	1 712	99.6
Total pieces	14 164	63	19 006	71	17 037	87	10 161	92

[a] Includes only two-thirds of laboratories which participated in tour.

TABLE II.—CLASSIFICATION OF CEMENT TESTING LABORATORIES INVOLVED IN THE VARIOUS INSPECTION TOURS

Interest	First Tour	Second Tour	Third Tour	Fourth Tour	Fifth Tour
Cement producers	99	108	104	100	120
Commercial testing laboratories	45	48	30	37	66
State highway department laboratories[a]	25	65	53	61	63
Schools	21	27	20	13	23
Municipal	11	10	9	6	10
Miscellaneous	7	7	8	12	14
Total	208	265	224	229	296

[a] Includes branch laboratories, some of which are located at cement plants.

tary, it is evident that the representative of the Reference Laboratory generally meets with a friendly and interested laboratory.

COMPARATIVE TESTS

The Reference Laboratory has been found a convenient agency for preparing and distributing samples to laboratories participating in cooperative tests, such as in the studies of fineness determination by the turbidimeter developed by L. A. Wagner, formerly a member of the Laboratory's staff. During the past year a sample of cement was distributed among 50 laboratories for comparison of the results obtained by the standard methods of test. The results of this last mentioned series were in general in closer agreement than in comparative tests of preceding years. The details of this series are given in an appendix to the 1937 report of Committee C-1.[5] Realizing the refinements in tests and apparatus which have occurred during the past few years, it is not claimed that the Reference Laboratory be given credit for all of the improvement in comparative test results. However, it is well known that many of the improvements in procedure and apparatus have been promoted by the Laboratory's inspection reports, and therefore in Table III there is offered a comparison of the results from some random selections from comparative test series of years past, illustrating that closer agreement in cement test results is obtained by laboratories now than was formerly to be expected.

SPECIAL TESTS OF CEMENT

Ordinarily the Reference Laboratory tests no samples submitted by others, and under no circumstances does the Laboratory make any arbitration tests. However, the Laboratory was selected by Committee C-1 as the agency to make certain tests on a group of cements to determine whether a certain material added to the cements during grinding could be considered as non-deleterious and acceptable under the new A.S.T.M. Standard Specifications for High-Early-Strength Portland Cement (C 74 - 36),[6] in which specification it is provided that such special tests shall be conducted by the committee.

GENERAL

The foregoing presents the reasons for the establishment of the Reference Laboratory and explains how it operates. When the work of the laboratory is reviewed over the period of its existence and consideration given to the nature of the correspondence, inspection reports, comparative test results and other miscellaneous information, it appears that the Committee on Cement, through this project, has been very helpful in improving conditions attendant on the performance of the standard tests required by the A.S.T.M. specifications, and has also assisted in developing some of the requirements for new tests. With the increasing use of these newer standards, the Laboratory should find a larger field for calibration and a considerable increase in the variety of apparatus to be inspected.

In closing, it is fitting that acknowledgment should be made to the organizations and individuals who have particularly assisted in making this project possible. The Society has generously participated in the preliminary arrangements and in the subsequent supervision. The Portland Cement Association has heartily cooperated through its laboratory staff and has continuously assisted in arranging for the essential contributions to the special A.S.T.M. funds. The Bureau of Standards has generously aided with person-

[5] Report on Tests of Portland Cement Comparative Sample C.R.L. No. 1, to appear in *Proceedings*, Am. Soc. Testing Mats., Vol. 37, Part I, (1937).

[6] 1936 Book of A.S.T.M. Standards, Part II, p. 4.

TABLE III.—COMPARISON OF MEAN VARIATIONS IN SOME RANDOM SELECTIONS OF REPORTS OF COMPARATIVE TESTS CONDUCTED BY DIFFERENT LABORATORIES IN PAST YEARS

Sample	Date	No. 200 Sieve Test		Setting Time Test (Gillmore)				Tensile Strength Test (1:3 Mortar)			
				Initial		Final		7-Day		28-Day	
		Mean Variation, Per Cent	Laboratories	Mean Variation, Per Cent	Laboratories	Mean Variation, Per Cent	Laboratories	Mean Variation, Per Cent	Laboratories	Mean Variation, Per Cent	Laboratories
A	1918	8.2	14	12.3	14	12.4	14	10.0	14	5.1	13
B	1920	4.6	28	22.5	28	15.9	28	11.7	29	10.0	28
C	1920	11.5	46	21.6	46	16.2	43	9.8	48	8.9	42
D	1922	3.6	7	19.0	9	13.4	8	6.4	9	2.5	8
E	....	4.1	25	21.6	25	18.7	24	9.4	33	8.2	33
F	1923	8.0	12	21.4	17	9.2	17	12.8	18	5.6	18
G	1924	19.8	46	21.8	47	14.8	46	10.6	47	6.4	43
H	1926	7.6	57	15.1	65	14.6	65	9.4	63	7.8	63
J	1926	7.7	57	17.3	64	14.1	63	7.3	62	7.2	62
K	1928	14.8	45	20.0	54	19.3	54	7.0	58	4.6	57
L	1928	....	....	....	....	....	....	9.4[a]	46	7.9[a]	46
M	1936	19.7	17	5.1	18	8.0	18	....	....	....	....
N	1936	15.6	44	11.9	45	11.6	45	4.6[b]	45	4.8[b]	45
O	1936	7.9	15	11.4	15	12.5	15	4.4	15	4.0	15

[a] Average of test of 32 cements.
[b] Average of tests on 3 different days.
Samples A and B distributed by a general interest laboratory to its branches; C, D, E, G, H, J, K distributed by Government Bureau; F and O distributed by a State Highway Department; N distributed by Cement Reference Laboratory.

nel, equipment, advice and direct supervision, without which aids the laboratory could not have functioned so readily. Dr. L. J. Briggs, Director of the Bureau, and C. L. Warwick, Secretary-Treasurer of the Society, have shown a kindly and very helpful interest in the work. P. H. Bates, Chairman of Committee C-1 during the existence of the Laboratory, as Chief of the Bureau's Clay and Silicate Products Division to which the Reference Laboratory is allocated has directly supervised the project since its establishment. W. M. Kinney, General Manager of the Portland Cement Association and George E. Warren, Chairman of the Reference Laboratory Subcommittee, both have rendered continuous and very helpful aid and advice. The late Frederick W. Kelly particularly promoted the work through his persevering advocacy of the project and his later active interest in its direction. Throughout the work, the fellow members of the Bureau's staff have generously contributed advice, instructions, calibration of equipment, loan of special apparatus, extending that aid which is of such great value to associateship projects at the Bureau.

Speed Control for Screw-Power Testing Machines Driven by Direct-Current Motors[1a]

by A. H. Stang[2] and L. R. Sweetman[2]

MODERN requirements for mechanical testing procedure are tending to specify more definitely than in the past, the speeds at which tests are to be made. Speed control for testing machines hydraulically driven is obtained by the manipulation of either the main or the relief valve or both and is comparatively simple. Platen speeds for the older types of testing machines which have constant ratios of platen speed to motor speed are generally restricted to a small number of speeds. Many of such machines are, however, in service and a description of the method of speed control for the screw-power testing machines driven by direct-current motors, which has been in use at the National Bureau of Standards since 1928, may be of value. The method has been known for many years, but not as widely as its usefulness warrants. To the best of our knowledge it has not been applied elsewhere to testing machines.

ORDINARY METHODS OF CONTROL FOR SHUNT MOTORS

The screw-power testing machines at the Bureau are driven by direct-current electric motors of either the shunt or compound type. Four general methods[3] are in use for changing the speed of such motors.

Method 1.—Changing the reluctance of the magnetic circuit. In order to accomplish this, a motor of special design is necessary in which the reluctance of the magnetic circuit can be varied by changing the length of the air gap between the poles and the armature. Motors of this type are comparatively expensive and have not, as far as is known, been extensively used for testing machines.

Method 2.—Changing the resistance of the field circuit. If a rheostat is put in series with the field circuit, the speed of the motor is increased. The useful range of speed change by this method is rather limited with motors of the older type without interpoles because excessive sparking at the commutator takes place when the field becomes relatively weak. The use of motors having interpoles which provide a local commutating flux and which have a field rheostat is, however, satisfactory for increases of motor speed by as much as 5 or 6 times the normal speed. With this method of control, the maximum torque available is reduced at the higher speeds. The requirements for testing procedure call generally for a decrease rather than for an increase in motor speed and this method has therefore rather definite limitations.

Method 3.—Changing the resistance of the armature circuit. If a rheostat is put in series with the armature, the speed of the motor is decreased. This method can be used to decrease the motor speed to about one-half of its normal speed. For a greater reduction of speed, the speed falls off very rapidly with small changes in load[4] and the method cannot be used satisfactorily for low speeds.

Method 4.—Changing the voltage applied to the armature. The speed of a shunt motor varies with the armature voltage and if a range of voltages lower than the normal voltage is available for the armature, while the field voltage is maintained at the normal value, the motor speed may be decreased. Thus by the use of 115 v. on the armature and 230 v. on the field of a 230-v. motor the motor speed will be reduced to about one-half of its normal value. Ordinarily other voltages are not available and the resulting two speeds are not sufficient for the desired range of speeds.

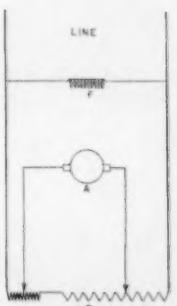

FIG. 1.—Armature-Voltage Method of Speed Control by Potentiometer Principle.

F—motor field; A—motor armature; R—rheostats

ARMATURE VOLTAGE METHOD OF SPEED CONTROL BY POTENTIOMETER PRINCIPLE

Description:

The method of speed control by changing the voltage applied to the armature may however be extended from rated motor speed to a full stop by use of the potentiometer

[1] Publication approved by the Director of the National Bureau of Standards of the U. S. Department of Commerce.

[a] Presented at the Fortieth Annual Meeting, Am. Soc. Testing Mats., New York City, June 28-July 2, 1937.

[2] Senior Materials Engineer, and Engineering Aide, respectively, National Bureau of Standards, Washington, D. C.

[3] F. B. Crocker and M. Arendt, "Electric Motors," p. 38, D. Van Nostrand Co., New York City (1910).

[4] T. Carter, "D.C. Motor Speed Regulation by Resistance in the Armature Circuit with Special Reference to the Diverter Method," *The Electrician* (London), Vol. LXXV, p. 953 (1915). Abstracted in *Electrical World*, Vol. 66, p. 934 (1915).

principle[5] as represented diagrammatically in Fig. 1. The line voltage is maintained on the field and also on a rheostat. The armature voltage may be varied by the potentiometer principle as indicated, with resultant change in motor speed. This method is inefficient to the extent that the potentiometer

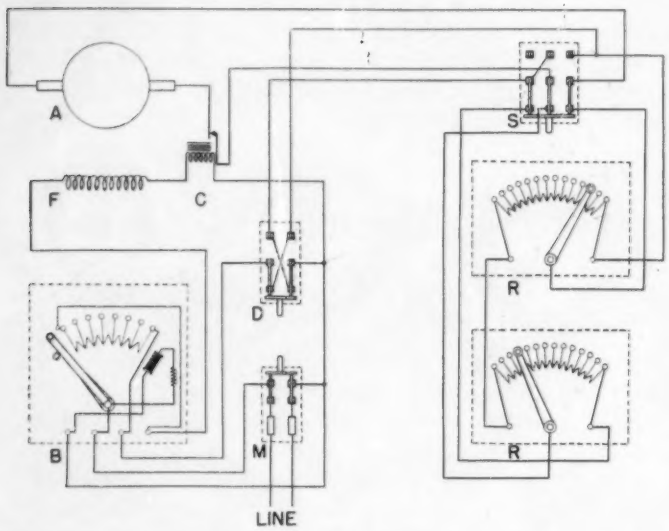

FIG. 2.—Wiring Diagram for Shunt Motor with Speed Control.

A, motor armature; *F*, motor field; *B*, starting box; *C*, current relay; *D*, switch for changing direction of motor rotation; *M*, main-line fused switch; *S*, switch for changing from normal operation to speed-control operation; *R*, rheostat.

range and the motor may have comparatively good torque characteristics[4].

This method of speed control has been in use at this Bureau for many years as well as in industry.[6, 7] At the Bureau its use was suggested about 30 yr. ago by H. B. Brooks of the Bureau staff. It was used for controlling the speed of rotation of a flicker-photometer device, of the rotating member of a sensitometer, and of several devices in the photographic research laboratory. Its use with testing machines was suggested by L. B. Tuckerman of the Bureau staff as early as 1928. All of the screw-power testing machines of the Engineering Mechanics Section, one of which has a rating of 15 hp., are now equipped with this type of speed control.

Rheostats:

The rheostats in use at the Bureau have a resistance equal to the line voltage divided by the rated current of the motors with which they are used. In this case, the safe carrying capacity of the rheostats should be equal to twice the rated current of the motor. These design values represent a practical compromise between very good speed-torque characteristics with high power loss and poor speed-torque characteristics with low power loss.

The rheostats[8] have independent terminals brought out at each end and from a contact arm. The contact arm makes contact with several points equally spaced along the rheostat and also with points at the ends of the rheostat. The use of two rheostats in series, as shown in Fig. 1, has been found

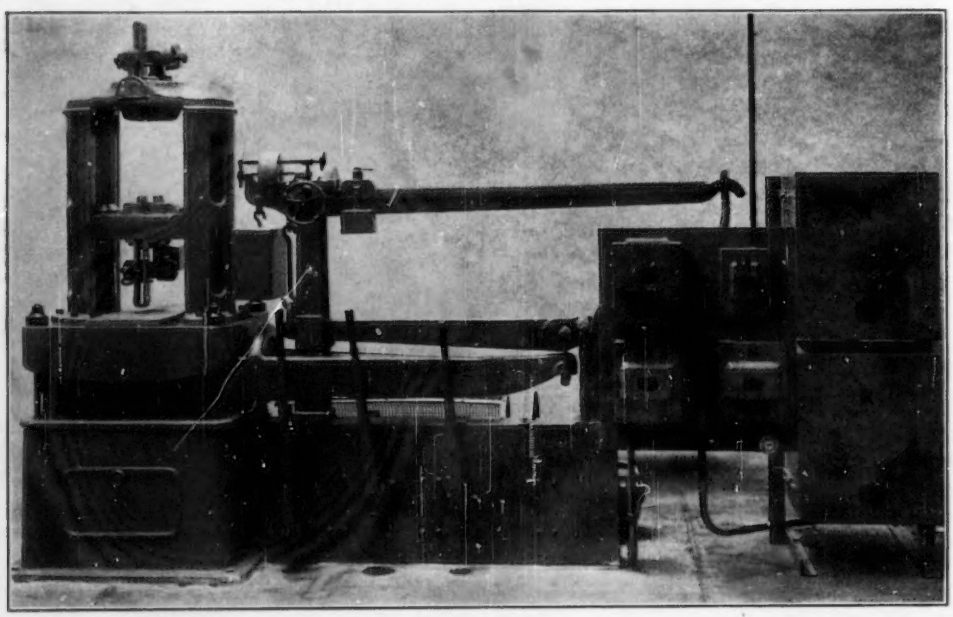

FIG. 3.—Screw-Power Beam-and-Poise Testing Machine with Speed-Control Rheostats.

B, starting box; *D*, switch for changing direction of motor rotation; *M*, main-line fused switch; *S*, switch changing from normal operation to speed-control operation; *R*, rheostat.

rheostat consumes an amount of power which is comparable to that used by the motor during normal speed operation. The more nearly the speed is to be independent of the load, the more power is wasted in this rheostat to obtain the speed-control features. The energy requirements of testing machines represent but a small part of the testing costs, and the increase in efficiency of testing made possible by the speed control more than outweighs the expense of the wasted energy. By a proper choice of the resistance, any desired speed may be obtained throughout the entire speed preferable to the use of a single rheostat for producing small changes in speed to give a coarse and fine adjustment and to provide a much larger number of possible operating

[5] L. G. Hoxton, "A Simple Speed Control for Small D.C. Motors," *Science*, Vol. 84, p. 187 (1936).

[6] T. A'Becket, "Speed Control of Motors Driving Printing Presses and Machine Tools," *American Electrician*, Vol. 12, p. 213 (1900).

[7] J. T. Mould, "The Starting, Regulating, and Stopping of Continuous Current Motors," *The Electrician* (London), Vol. LX, p. 140 (1907).

[8] L. Boothman, "Potentiometer Rheostats and Rheostats with Protective Resistance," *Electrical Review* (London), Vol. 76, p. 427 (1915).

speeds. If there are 10 contact points on each rheostat, the use of two rheostats gives 100 speed settings. Convenient values of the resistances are 0.1 and 0.9 of the total resistance for the two rheostats. Each has the same current-carrying capacity and the same number of contact points.

Wiring Diagram:

Figure 2 shows the wiring diagram for a shunt motor with this method of speed control using two rheostats. When the handle of the 3-pole double-throw switch, *S*, is down as shown, the rheostats are across the line and the speed-control feature is in operation; when up, the rheostats are disconnected from the power line and normal operation and efficiency of the motor result. The current relay, *C*, shown in Fig. 2, obviates the possible danger of runaway as a series motor which might occur if a break took place in the field circuit.

Figure 3 shows a testing machine with two rheostats.

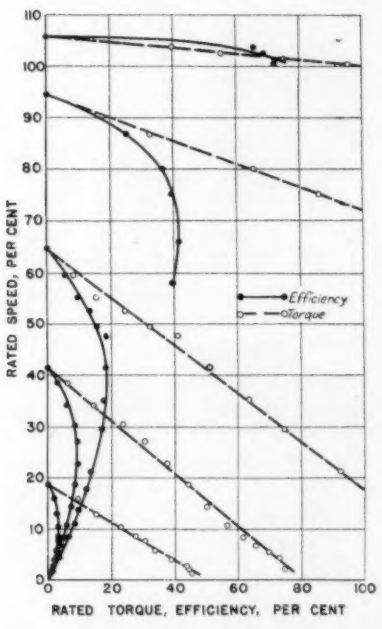

Fig. 4.—Speed-Torque and Speed-Efficiency Curves for Five Positions of the Rheostat Contact Arm.

Changes in the wiring are obvious if only a single rheostat is to be used. The circuit is easily modified for the case of a 3-point starting box, no starting box, no switch for reversing the direction of motor rotation, or for the use of the speed control for the loading direction of the testing machine and normal speed on the unloading or return direction. Each of these variations in the wiring is in use.

Motor Characteristics:

The characteristics of a shunt motor, 2 hp., 230 v., using this method of speed control are shown in Fig. 4 for five positions of the contact arm.

Although the output and the efficiency decrease as the speed is reduced by loading the motor[4], the torque continues to increase with decrease in speed. This results in satisfactory operation of the machine. When the load becomes so great that the speed is reduced by an undesirable amount, the speed can be increased by the movement of the contact arms. It will be seen that the particular values of resistance used in this application give reasonably satisfactory characteristics to the control. While a given change in load gives a greater change in speed at the lower control settings, it is possible to obtain the full torque of the motor down to the lowest speeds.

Uses:

Definite Rate of Platen Speed.—Screw-power testing machines generally have three or more speeds of platen travel which are obtained by gear shifts. It is seldom that these speeds obtainable by gear shifts are the speeds specified for the tests of such materials as, for example, Manila rope,[9] canvas[10] or rubber belting,[11] or other materials[12] for which the properties depend upon speed of platen movement. With this method of speed control any desired speed, not greater than the highest speed of which the machine is capable, can be obtained. Higher speeds if desired [3, 5] can of course be obtained by the use of an adjustable resistance in the field circuit of the motor. When the field is weakened, however, the maximum torque available is reduced.

Definite Rate of Stress Increase.—Speed control is necessary if the yield point by the drop-of-beam method for steel

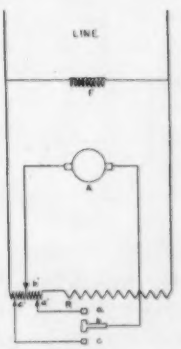

Fig. 5.—Wiring Diagrams for Load Maintenance.
F, motor field; *A*, motor armature; *R*, rheostats; *a*, *b*, *c*, contact points on testing machine; *a'*, *c'*, contact points of small rheostat; *b'*, contact arm of small rheostat.

specimens[13] or the compressive strength of mortars[14] is to be determined at a specified rate of stress increase. This can be accomplished with screw-power testing machines provided with this method of speed control by two operators; one operator balancing the beam and calling out at predetermined load increments; the other operator listening to a metronome and adjusting the position of the contact arms for a faster or slower speed as indicated.

Very Slow Speed.—For many testing machines, the slowest speed obtainable by gear shift is too fast for obtaining stress-strain data, using an extensometer on the specimen. With speed control, as slow a speed as desired may be ob-

[9] Federal Specification T-R-601a for Rope; Manila (1935).
[10] Federal Specification DDD-B-171 for Belting; Conveyor (1931).
[11] Standard Methods of Testing Rubber Belting Used for Power Transmission (D 378 - 36), 1936 Book of A.S.T.M. Standards, Part II, p. 1274.
[12] Standard Methods of Testing Brick (Compression, Flexure, Absorption) (C 67 - 31); Testing Small Clear Specimens of Timber (D 143 - 27); Conducting Static Tests of Timbers in Structural Sizes (D 198 - 27); and Testing Molded Materials Used for Electrical Insulation (D 48 - 33), 1936 Book of A.S.T.M. Standards, Part II, pp. 140, 465, 502, 1192, respectively.
[13] Proposed Requirements for Speed of Tension Testing of Metallic Materials, *Proceedings*, Am. Soc. Testing Mats., Vol. 31, Part I, p. 599 (1931).
[14] Tentative Method of Test for Compressive Strength of Portland-Cement Mortars (C 109 - 34 T) *Proceedings*, Am. Soc. Testing Mats., Vol. 34, Part I, p. 743 (1934), also 1936 Book of A.S.T.M. Tentative Standards, p. 393.

tained. Between extensometer readings the machine can be run at higher speeds and slowed down without jar just before another reading is to be taken.

With a speed sufficiently slow, stress-strain data may indeed be taken without stopping the machine to obtain readings.

A slow speed is also desirable for the verification of testing machines by proving levers or elastic calibration devices.

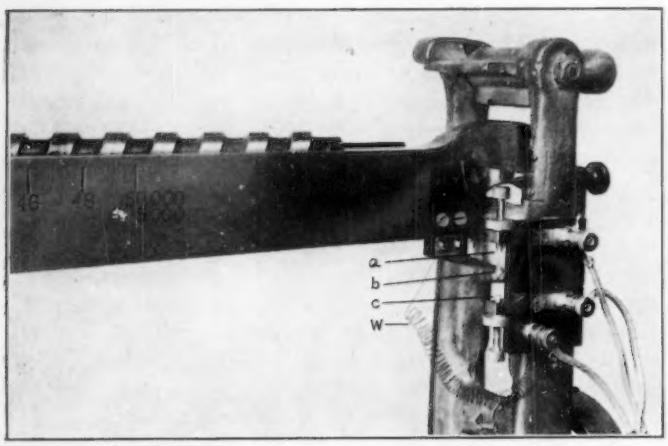

FIG. 6.—Contact Points for Load Maintenance.
a, *b*, *c*, contact points; *W*, wire from contact point *b* to one side of motor armature.

Load Maintenance.—This method of speed control makes it simple to maintain a definite load on a specimen in the testing machine for any desired time or to bring the load to the value for which the poise on the beam of the testing machine is set and then maintain this load.

To accomplish this, the wiring must be rearranged to some extent, the reversing switch must be set for the motor direction which will increase the load, and the clutch lever of the testing machine must be engaged. The wiring diagram for load maintenance is given in Fig. 5. One side of the armature is left connected to the contact arm of the small rheostat (indicated at *b'*, Fig. 5) and this contact arm is placed at about the middle of the rheostat points. The other side of the armature is disconnected from the throw-over switch *S* (Fig. 2) and connected to the contact point *b* (Figs. 5 and 6) mounted on the end of the testing machine beam. Other contact points *a* and *c* attached to the trig loop and placed in line below and above points *b*, as indicated in Fig. 5 and shown in Fig. 6, are connected electrically to contact points *a'* and *c'*, respectively, of the small rheostat on either side of the contact arm *b'*. These contact points, *a'* and *c'*, may or may not be chosen to include equal numbers of steps of resistance on either side of the contact arm *b'* according to the desired loading and unloading rates. The wiring is done in such a manner that when contact points *c* and *b* are together (the beam is down), the motor turns in the direction to increase the load and continues to increase the load until the contact between *c* and *b* is broken and the beam is balanced. If the load decreases, due to stretch in the specimen or for any other cause, the beam will drop, contact between *c* and *b* will again be made and the motor will turn in the loading direction.

If the load increases, the beam will rise until contact points *b* and *a* touch when the motor will run in the unloading direction until the contact is broken. The motor will then stop when the beam is again balanced. The same action will occur if the poise is purposely set at a lower load position.

The wire *W*, leading from contact point *b* on the end of the beam to the connection to the motor armature, should be small in diameter and fairly long or coiled as shown in Fig. 6 so as to exert negligible forces on the beam. Since the current-carrying capacity of such a wire is small, the armature voltage must be kept small by having the contact points relatively close together on the rheostat or relays must be used.

A Note on Copper Patina

by Peter R. Kosting[1]

INTEREST in the nature of patina which forms on weathered copper has resulted in marked changes[2, 3, 4] in the art and science of coloring copper intended for outdoor exposure. The classical work of Vernon and his collaborators[2, 5] showed that brochantite, a basic copper sulfate, was the essential constituent of copper patina except if exposed along the seacoast, and that many years of exposure must elapse before the sulfate had the correct basicity. Kirby and Freeman[3] in their analyses reported the presence of only very small amounts of Cl^-, $CO_3^=$, S^-, but in one case a large amount of cuprous oxide (Cu_2O) was detected. Cupric oxide (CuO) was the only constituent reported on copper transmission wire from Canada where it was weathered in a rural atmosphere.[2]

Comparison was made of the X-ray diffraction photograms of various copper compounds, including several basic sulfates, with those of patina from two copper roofs, one weathered for 10 yr. in Washington, D. C., and the other in Upper Montclair, N. J., for 16 to 20 yr. Brochantite ($4\,CuO{\cdot}SO_3{\cdot}3H_2O$) and cuprite ($Cu_2O$) were the only two compounds present in quantities detectable by X-rays. Chlorides, carbonates and sulfides were looked for but not detected. Further examination of the Washington patina showed it to be made up of two layers, the upper one of brochantite, and the lower one of cuprite adjacent to the copper.

[1] Chemical Engineer, Watertown Arsenal, Watertown, Mass.
[2] W. H. J. Vernon, "The Open Air Corrosion of Copper, Part III, Artificial Production of Green Patina," *Journal*, Inst. Metals (British), Vol. 49, No. 2, pp. 153-168 (1932).
[3] J. R. Freeman, Jr., and P. H. Kirby, "The Rapid Development of Patina on Copper," *Metals and Alloys*, Vol. 3, pp. 190-194 (1932).
[4] G. L. Craig and C. E. Irion, "Rapid Electrolytic Patina on Copper," *Metals and Alloys*, Vol. 6, pp. 35-37 (1935).
[5] W. H. J. Vernon and L. Whitby, "The Open Air Corrosion of Copper, A Chemical Study of the Surface Patina," *Journal*, Inst. Metals (British), Vol. 42, pp. 181-194 (1929); and "The Numeralogical Relationships of Corrosion Products, Part II," *Journal*, Inst. Metals (British), Vol. 44, pp. 389-396 (1930).
[6] E. Posniak and G. Tunell, "The System $CuO{\cdot}SO_3{\cdot}H_2O$," *American Journal of Science*, Vol. 18, No. 1, p. 12 (1929).

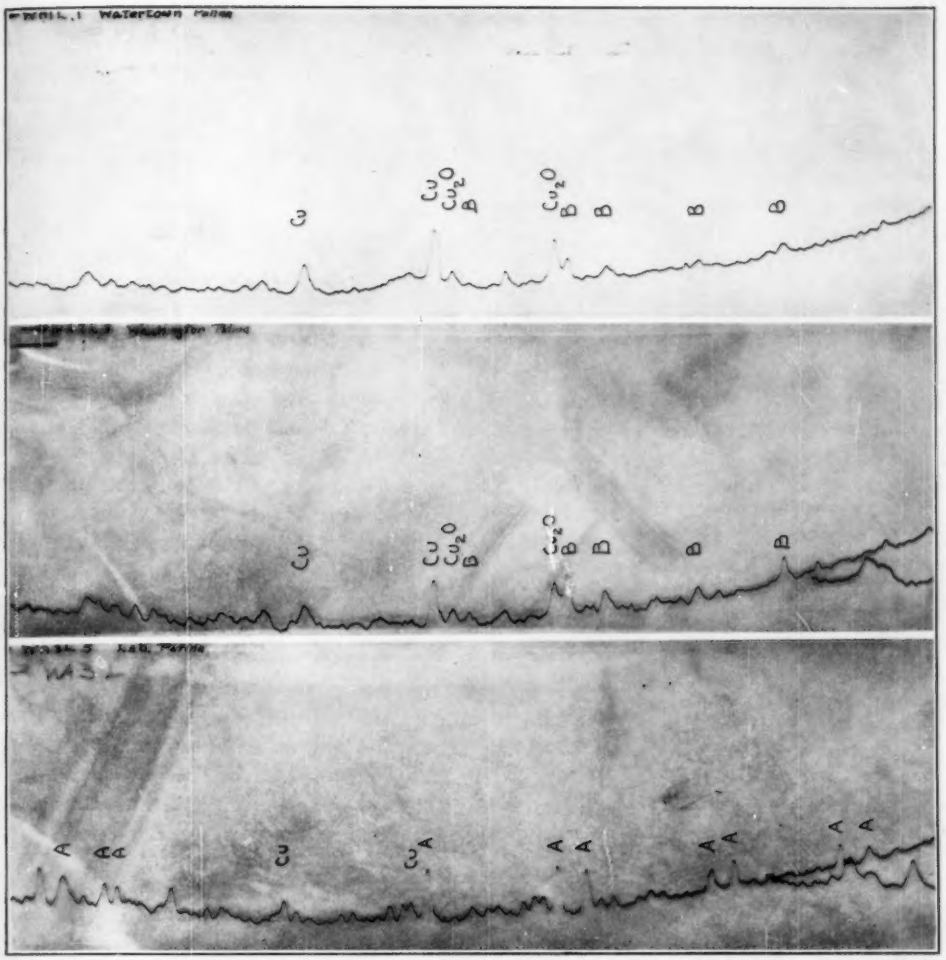

Figure 1

Densitometer Records of One-half of the X-ray Diffraction Patterns of Copper Patina.

Length Ratio $\frac{\text{X-ray film}}{\text{Densitometer film}} = 0.161$

A = antlerite
B = brochantite
Cu = copper
Cu_2O = cuprous oxide

The presence of cuprous oxide may account for the patina studied by others not having the basicity expected from considerations of brochantite alone. It also substantiates the necessity of "conditioning" the copper in some of the methods of coloring it. Of interest along this line is the copious formation of cuprous oxide under copper chloride formed in NaCl drop pitting tests on copper that had been heated to 100 C. previous to test. The importance of knowing the exact chemical compounds formed on metal surfaces due to corrosion cannot be overemphasized.

Rebuilding at Watertown, Mass., made available other copper patina but of unknown age. Patina from copper subjected to accelerated weathering in experiments reported in Research Paper No. 422, National Bureau of Standards *Journal of Research*, Vol. 8, 1932, p. 365, was also available for examination. Study of these with X-rays showed the Watertown patina to be the same as Washington patina, brochantite and cuprite being present. But the proportion of cuprite to brochantite in the Watertown patina was more than that in the Washington patina.

Only antlerite ($3CuO \cdot SO_3 \cdot 2H_2O$) was detected in the patina from copper which was acceleratedly weathered in the laboratory. Figure 1 is illustrative of the Debye-Shearer diffraction photograms obtained. From the data of Posnjak and Tunell,[6] antlerite would be the next basic sulfate to expect if the SO_2 content of the atmosphere were increased.

CONCLUSIONS

Studies of patina formed on copper weathered at Washington, D. C., Upper Montclair, N. J., and Watertown, Mass., showed it to be made up of a layer of brochantite over a layer of cuprite which was adjacent to the copper. In an acceleratedly weathered test, only antlerite was formed.

ACKNOWLEDGMENT

Prior to June, 1932, the original work was done at the National Bureau of Standards. Other diffraction photograms were taken by Prof. J. T. Norton, Massachusetts Institute of Technology, and also by Mr. D. Low, Watertown Arsenal; this help is gratefully acknowledged. Thanks are given to Col. G. F. Jenks and other officers at Watertown Arsenal for their interest and to the Ordnance Office for permission to publish.

Discussion of H. C. Mann's Paper on "High-Velocity Tension-Impact Tests"[1]

By H. C. Perkins[2]

A DISCUSSION of H. C. Mann's paper may well begin with a critical study of his formula for the work to rupture a specimen expressed in terms of the observed kinetic energy of the pendulum of his machine. Recognizing the desirability of an independent viewpoint when looking for possible errors, let us obtain an abbreviated expression for the work to rupture a specimen—an expression which lends itself more readily to analysis than does the form given in the paper.

Let

E' = the actual work to rupture the specimen
e' = the actual extension of the specimen
v' = the average speed of the tup
l = the weight of the tup
r = the radius to tup and specimen

[1] *Proceedings*, Am. Soc. Testing Mats., Vol. 36, Part II, p. 85 (1936).
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I_p = the moment of inertia of the pendulum
w_p = the angular velocity of the pendulum at rupture
L = the weight of the pendulum
R = the radius to its centroid
θ = the angle of swing of the pendulum
t = the time during which the specimen exerts a force on the pendulum
P = the average force exerted during this time.

The kinetic energy of the pendulum just after the specimen ruptures may be written

$$\frac{I_p w_p^2}{2} = LR(1 - \cos\theta) = \frac{I_p^2 w_p^2}{2I_p} \quad \ldots\ldots (1)$$

and the corresponding angular impulse and momentum for the pendulum is

$$rPt = I_p w_p = \sqrt{2I_p LR(1 - \cos\theta)} \quad \ldots\ldots (2)$$

But regarding E' as the area of the force-stretch diagram for the specimen, the average force required to stretch the specimen is equal to the mean ordinate,

$$P' = \frac{E'}{e'} \quad \ldots\ldots (3)$$

also the time during which the tup exerts a force upon the specimen is equal to the ratio

$$t' = \frac{e'}{v'} \quad \ldots\ldots (4)$$

Now if it be *assumed,* that $P = P'$ and $t = t'$ it follows that

$$rPt = r\frac{E'}{e'} \cdot \frac{e'}{v'} = \sqrt{2I_p LR(1 - \cos\theta)} \quad \ldots\ldots (5)$$

so

$$E' = \frac{v'}{r}\sqrt{2I_p LR(1 - \cos\theta)} \quad \ldots\ldots (6)$$

Making the further assumption that the speed v' of the tup is equal to the speed $v = wr$ of the wheel, this formula (6) for the work to rupture a specimen is equivalent to the first term of the formula derived in H. C. Mann's paper. His second term may represent the difference between the time average force P and the space average force P' but its value is generally small so it will be disregarded in the following discussion.

Aside from the assumption that $P = P'$ there are the further assumptions that the time t during which the force P acts upon the pendulum is equal to the ratio $\frac{e'}{v'}$, and that $v' = v$. Suppose first that the tup remains in contact with the wheel so that $v' = v$. There is reason to believe that even then the time t is not correctly expressed by the ratio $\frac{e'}{v}$.

One reason for this opinion is explained in Chapter 12 of S. Timoshenko's "Theory of Elasticity."[3] The impact of the wheel on the tup starts a wave of stress which does not immediately reach the pendulum. The time during which a force acts upon the pendulum may be shorter than the time during which a force is applied to the specimen by the tup. Any work done to extend the specimen before the wave of stress reaches the pendulum will not be represented by a corresponding impulse given the pendulum so the formula may underestimate the work to rupture the specimen. Up to the yield stress in a ductile specimen, the primary wave stresses the specimen in proportion to the speed of loading. But above the yield stress there may be a radical change in the conditions of wave transmission and possibly an appreciably increased error in the calculated work to rupture. This consideration suggests the possibility of calculating the "critical velocity" of loading from the yield stress of the specimen, using Eq. 250 on p. 384 of Timoshenko's "Theory of Elasticity." In the case of the S.A.E. 1035 annealed steel the observed critical speed is about 30 ft. per sec. and the calculated speed by the above formula is also about 30 ft. per sec. Taking the yield stress as probably about $S = 50{,}000$ lb. per sq. in., the elastic modulus as $E = 30{,}000{,}000$ lb. per sq. in., and the mass density as $m = \frac{490 \text{ lb. per cu. ft.}}{32.2 \text{ ft. per sec. per sec.}} = 15.2$

$$v = \frac{S}{\sqrt{Em}} = \frac{50\ 000(144)}{\sqrt{30\ 000\ 000(144)15.2}} = 30 \text{ ft. per sec., nearly.}$$

This is very interesting but may be a coincidence, for some of the other critical speeds given in the paper make this theory look very doubtful to say the least.

The analysis described by Timoshenko when applied to a specimen which has a straight stress-strain curve of slope E, up to its rupture stress S, and strain e,, leads to some interesting results. Suppose the specimen to be loaded at a speed which would stress the specimen above its ultimate strength S,. The specimen will rupture at the tup end without imparting an appreciable impulse to the pendulum. The calculated work to rupture the specimen vanishes—which is quite correct. Now suppose that the speed of loading be reduced until the impact stresses the specimen just below its ultimate strength. The impact will start a wave of stress of intensity S, at the tup. When this wave reaches the pendulum the specimen is moving with velocity v, relative to the pendulum. The pendulum being at rest, it applies a second impact load with speed v, to stretch the specimen but the specimen being already stressed to its ultimate, this additional impact causes rupture at the pendulum end of the specimen. The actual unit work to rupture the specimen is $U = \frac{S^2}{2E}$ but the pendulum has received a vanishingly small impulse, and has acquired no kinetic energy. Therefore

$$E = \frac{v}{r}\sqrt{2I_p LR(1 - \cos\theta)} = 0$$

a result which in this case certainly does not represent the work done in deforming the specimen.

If the speed of loading be decreased there is a corresponding decrease in the wave stress $S < S$, but the specimen ruptures at the pendulum without imparting an impulse to the pendulum. The actual unit work to rupture the specimen is expressed by the decreasing value of the quantity, $U = \frac{S^2}{2E}$ while the work to rupture calculated from the Mann formula vanishes until the speed of loading drops to a value less than half the value v,, $v = \frac{v_r}{2}$ corresponding to primary wave stress $S = \frac{S_r}{2}$. In this case the primary stress $\frac{S_r}{2}$ is doubled by reflection at the pendulum, as described in Timoshenko's "Theory of Elasticity," Chapter 12, and rupture does not occur until the returning wave of stress reaches the tup. The specimen, then moving very slowly at pendulum speed, is stressed to its ultimate strength S, so the tup moving at speed v applying additional stress to accelerate the specimen causes rupture at the tup. In this case the force on the pendulum is equal to the ultimate strength P, of the specimen. During the time P, acts on the pendulum, the specimen receives half of its ultimate extension, $\frac{e_r}{2}$ at a rate v so the time $t = \frac{e_r}{2v}$. The resulting angular momentum of the pendulum is

$$\frac{rP_r e_r}{2v} = I_p w_p = \sqrt{2I_p LR(1 - \cos\theta)}$$

[3] McGraw-Hill Book Co., Inc., New York City.

The actual and the calculated values of the work to rupture therefore agree.

$$E = \frac{P_r e_r}{2} = \frac{v}{r}\sqrt{2I_p LR(1-\cos\theta)}$$

A similar analysis indicates that this agreement continues until the primary wave stress becomes less than 1/3 of the ultimate strength of specimen, $S < \frac{S_r}{3}$.

Examining these results and recollecting the assumptions upon which the Mann formula is based, it appears that this formula cannot yield correct results if the specimen has kinetic energy at rupture. This is a condition which cannot be satisfied, the tup end of the specimen must have kinetic energy at rupture. In the case of a ductile specimen, however, that portion of its gage length which remains attached to the pendlum has, just before rupture, very little kinetic energy. The deformation in such a specimen is at that time practically all localized at the neck so the pendulum end of the specimen is then moving at the speed of the pendulum. The speed of the pendulum being relatively small, the change of momentum of this end of the specimen may be neglected. It follows that the impulse of the force at the neck section cannot differ appreciably from the impulse of the force at the pendulum end section.

If a ductile specimen is *observed* to rupture at the midpoint of the gage length and be equally extended in its two portions, the Mann formula may express correctly the work to rupture the specimen.

Let, E'' = the work done to stretch the pendulum half.

$e'' = \frac{e}{2}$ = the extension of this half

$v'' = \frac{v}{2}$ = the speed of the neck section

$P = \frac{E}{e} = \frac{2E''}{e}$ = average force on the pendulum

$t = \frac{e''}{v''} = \frac{e}{v}$ = time of deformation,

The angular impulse momentum equation for the pendulum is then

$$rPt = I_p w_p = \sqrt{2I_p LR(1-\cos\theta)}$$
$$= \frac{r2E''}{e}\cdot\frac{e}{v} = 2r\,\frac{E''}{v}$$

Therefore $E'' = \frac{1}{2}\,\frac{v}{r}\sqrt{2I_p LR(1-\cos\theta)}$ ..... (7)

The work to stretch the pendulum half of the specimen is equal to half of the calculated work to rupture the entire specimen.

More generally, if rupture divides the specimen into two unequal portions in both of which the unit deformation is the same, the Mann formula should be accurate at low speeds. For supposing some fraction n of the specimen to remain attached to the pendulum after rupture, it may happen that the same fraction n of the total deformation of the specimen occurs in the pendulum end. If so it follows just as in the special case above, where $n = 1/2$ leading to equation 7, that the work to stretch the pendulum end of the specimen is expressed by the formula

$$E'' = n\,\frac{v}{r}\sqrt{2I_p\ LR(1-\cos\theta)}$$

Therefore if the unit deformations in the two ends of a ductile specimen, ruptured at low speed, are approximately equal, the Mann formula probably estimates with satisfactory accuracy the work to rupture the specimen.

But there is a possibility that the speed of deformation v, equal to the speed of the tup, is not equal to the speed wr of the wheel, as assumed in the formula. If these speeds are not equal, the critical velocities determined by the tests are not actual rates at which specimens are deformed and are therefore inaccurate. Furthermore, if the tup is moving faster than the wheel at rupture, the actual speed of deformation v' is greater than the value $v = r\,w$ used in calculating the work to rupture the specimen, and the calculated result underestimates the work to rupture the specimen. That there will be such a velocity difference at high speeds is evident from an analysis of the impact between tup and wheel. That impact is not complete when the tup reaches wheel speed. The impact forces between wheel and tup cause internal deformations which are in part elastic. If at the end of the first period of the impact, the wheel and tup have a common speed $v = r\,w$, and if the coefficient of restitution in the impact is c, the final speed v_2 of the tup may be calculated from the formula

$$\text{Therefore}\quad c = \frac{v_2 - v}{v - 0}$$
$$v_2 = (1+c)\,v \ldots\ldots\ldots\ldots\ldots\ldots (8)$$

The tup which during the first period of the impact is accelerated to wheel speed v, continues to accelerate during the second period of the impact finally attaining a speed $v_2 = (1+c)\,v$. If $c = 1$, $v_2 = 2v$. The change in kinetic energy of the tup during the second period has a value

$$U = (1+c)\,\frac{^2v^2l}{2g} - \frac{v^2l}{2g} = c\,(2+c)\,\frac{v^2l}{2g} \ldots\ldots\ldots (9)$$

But the specimen exerts a force P', on the tup, to prevent its acceleration above wheel speed or to bring it back to wheel speed. At low speeds the specimen can absorb the energy U without rupture, so at low speeds the tup is moving at wheel speed just before rupture, but at high speeds the specimen is incapable of absorbing the energy U without rupture so the tup is moving faster than the wheel at rupture. In this case the average speed v' of the tup exceeds the wheel speed v, thus decreasing the time t' to rupture the specimen and the time t during which a force acts on the pendulum. A more accurate expression for estimating the work done to rupture the specimen is in this case

$$E' = \frac{v'}{r}\sqrt{2I_p\,LR\,(1-\cos\theta)}$$

The calculated energy to rupture should be corrected by the factor $\frac{v'}{v}$ which increases with the speed v. According to the above analysis, as soon as the elastic energy stored in the impact of wheel and tup exceeds the work to rupture the specimen, the "critical speed" is passed and the calculated energy begins to decrease. The energy stored in the impact, although it obviously does have an important effect upon the energy as calculated by the Mann formula, in either the original or the abbreviated form, does not suffice to explain the experimental results, for the work to rupture at critical speed plotted against the square of the corresponding critical speed does not locate a series of points on a straight line through the origin. However, variations in the weight of tup

and specimen cannot be neglected, and there is certain to be considerable variation in the nature of the contact between horns and tup, varying quantities of energy lost in the grips, etc.

In the above discussion certain conditions are suggested under which at low speeds the Mann formula may express correctly the work to rupture a ductile specimen. But at high wheel speeds it is evident that when the specimen ruptures, the velocity of the tup must exceed that of the wheel. Therefore critical velocities determined in the manner described in the paper, even if they are characteristic of the specimens tested, may not have the values determined in the paper. At high speeds, also, the increased velocity of the tup operates to decrease the impulse on the pendulum and to result in an underestimate of the work to rupture the specimen. The analysis of elastic impact, described in Chapter 12 of Timoshenko's "Theory of Elasticity," when applied to a brittle specimen loaded in constant speed impact leads to the conclusion that the Mann formula will, in some cases, underestimate the work to rupture a specimen—a conclusion which casts some doubt upon all results calculated by that formula. The elastic analysis also suggests that a speed of loading which initially stresses a ductile specimen to its yield point may be a "critical speed" above which the calculated work to rupture the specimen becomes appreciably less than the actual work to rupture.

H. C. Mann has obtained some very interesting results in his high velocity tension-impact tests but there is some doubt as to the validity of the conclusions which he draws from those results.

Reply by H. C. Mann[1]

THE critical discussion by Professor Perkins, of the formula for the work of rupture developed for the High-Velocity Impact Machine, is appreciated.

The analysis proposed, however, is the same as that originally suggested by Prof. E. B. Norris, Dean of Engineering, Virginia Polytechnic Institute, and later revised to that appearing in the paper referred to. In this analysis, time "t" is used as a factor in the equation. This term, however, can only be obtained by assuming an average velocity and by measuring the total elongation of the specimen after rupture. Since the velocity is actually a variable, this assumption introduces an error in the earlier analysis. The final analysis as presented eliminates the necessity for considering the elongation and makes use of a mathematically correct formula by integrating the force and velocity terms, rather than assuming average values.

The analysis as developed at Watertown Arsenal contains only two assumptions, the validity of which has many times been questioned but as yet not proved incorrect. These are:

1. The force acting at both ends of the gage length of the specimen is equal and opposite.
2. The tup remains in contact with the striking horns, reaches the velocity and becomes a part of the rotating mass during the period of elastic deformation.

The analysis as presented by Professor Timoshenko deals only with the stress within the elastic range. As soon as permanent deformation occurs, an entirely new condition is obtained, and the basic elastic theories are no longer applicable.

[1]Senior Materials Engineer, Watertown Arsenal.

Concerning certain of the references in Professor Perkins' discussion which bear on the values obtained from actual tests—consider first the formula for calculating the critical velocity of loading from the yield stress of the material,

$$V = \frac{S}{\sqrt{Em}}$$

In this formula an increase in S (yield stress) would result in an increase in transition velocity. The transition velocities of S.A.E. No. 1035 steel—when quenched and drawn at 400 F, 600 F, 800 F, 1000 F, 1300 F, and normalized from 1650 F—are shown in Fig. 1. The draw at 400 F naturally resulted in the highest yield value, showing a transition velocity of only 70 ft. per sec., the hign draw at 1300 F producing a much lower yield strength, showing a transition velocity above 150 ft. per sec.

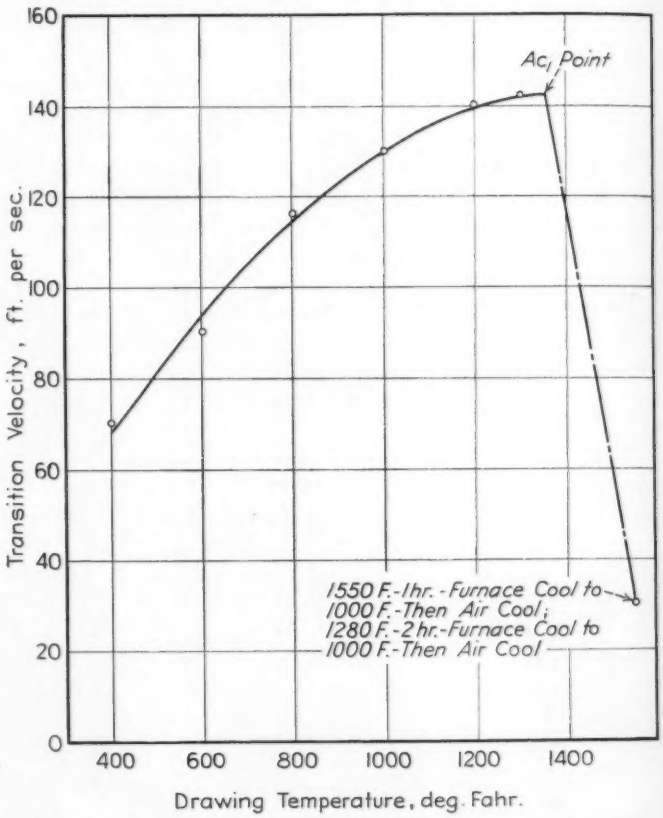

FIG. 1.—TRANSITION VELOCITY—DRAWING TEMPERATURE RELATION, S.A.E. No. 1035 STEEL.

1700 F.–3 Hr.–Air Cool; 1550 F.–1 hr.–Water Quench; Draw as noted.

From an investigation of the microstructure of specimens broken at below and above the various transition velocities, conducted by Lt. Rodenhauser, Ordnance Dept., in compliance with the requirements for a Master's thesis, Mass. Inst. of Technology, 1937, it was shown that in every case at velocities above the transition point a dissociation in lattice structure in the shear planes takes place—which is not evident in any specimen tested below the transition point.

Another practical example of the probable correctness of the analysis of the high velocity machine is found in the results from S.A.E. No. 3435 steel in the temper brittle condition tested under comparative conditions in the 300 kgm. Charpy machine and the high velocity machine. The results

from each machine were the same, the material in the temper brittle condition showing a transition velocity of approximately 15 ft. per sec. and a decrease in energy values at velocities above this point, in the Charpy machine the lowered velocity values being obtained by decreasing the height of fall of the pendulum.

The maximum velocity of the Charpy machine is only 28.5 ft. per sec., which naturally eliminates the possibility of any further comparison with the high velocity machine. However, a large number of materials have been tested since the paper under discussion was submitted, and the transition points determined have shown no relation whatsoever with any physical property of the material; they have varied from 5 to 320 ft. per sec., and have shown that they can be varied by heat treatment.

Tests at low temperatures, using the 300 kgm. Charpy impact machine and reported at the Fortieth A.S.T.M. Annual Meeting, again prove the presence of transition velocities and the effect of temperature on this factor.

Regarding the position of break of the test specimen—the present procedure is to slightly taper the specimen toward the middle, and, no matter what the velocity, the break always occurs at this point. Without a slight taper the break occurred as in a static test, generally at the middle but sometimes at or near one end, the end break, however, having no relation to the position of the tup, breaking as often at the pendulum end as at the tup end. The purpose of the slight taper was to eliminate this condition and has proven entirely satisfactory.

1938 Meetings in Rochester, Atlantic City

AFTER detailed consideration of the numerous questions involved in selection of places for the Regional Meeting and Annual Meeting of the Society, the Executive Committee has selected Rochester for the 1938 Regional Meeting and Atlantic City for the 1938 Annual Meeting, the Society's forty-first.

The Regional Meeting will be held on Wednesday, March 9 during A.S.T.M. Committee Week which will extend throughout five days of the week beginning March 7. The technical feature of this meeting, a Symposium on Plastics, is being sponsored by Committee D-20 on Plastics, organization of which is announced in this BULLETIN, in cooperation with the Rochester Committee. W. E. Emley, chairman of Committee D-20 and a member of Committee E-6 on Papers and Publications, will serve as chairman of the Symposium Committee. Preliminary plans provide that the five subcommittees of D-20 which are concerned with strength, hardness, thermal, optical and permanence properties, would each sponsor one paper to be included in the symposium.

Local arrangements for the meeting will be in the charge of a group of members in the Rochester area, the committee being headed by Dr. I. C. Matthews of the Eastman Kodak Co.

The decision to return to Atlantic City again for next year's annual meeting was made by the Executive Committee after careful consideration of various comments made by a number of members. The possibility of holding a meeting at another eastern resort was discussed, but it was felt best from the standpoint of the various Society requirements to return to Atlantic City where so many successful meetings have been held.

DISTRICT COMMITTEE NOTES

Southern California District Meeting

UNDER the sponsorship of the Southern California District Committee of which R. R. Martel, Associate Professor of Civil Engineering, California Institute of Technology, is chairman, and E. O. Slater, Vice-President and Manager, Smith-Emery Co., is secretary, a meeting of the members of the Society and their friends in this district was held at the California Institute of Technology, Pasadena, on the afternoon of June 19. Following a luncheon at the Atheneum, there was an inspection of the 200-in. telescope and the Metallurgical Laboratories of the Institute. The technical portion of the meeting followed at 2:30 p. m. This was featured by talks by A. O. Beckman, Assistant Professor of Chemistry, California Institute of Technology, on "Applications and Significance of the pH Test" and by T. E. Stanton, Materials and Research Engineer, California State Highway Dept., on the subject "The Role of the Laboratory in Investigation and Control of Foundations and Materials of Construction." There was an excellent attendance of members at the meeting and inspection and considerable discussion of Mr. Stanton's paper.

Appointments to District Committees

THE terms of office of a number of members of the eight A.S.T.M. District Committees expired with the 1937 annual meeting and the president has made the following appointments for the respective districts—these include a number of new members. The appointments are for a three year term.

Chicago District Committee—C. E. Ambelang, Public Service Co. of Northern Illinois; J. DeN. Macomb, Inland Steel Co.; W. A. Straw, Western Electric Co., Inc.; E. R. Young, Climax Molybdenum Co.; J. F. Calef, Automatic Electric Co.

Cleveland District Committee—A. J. Tuscany, Consultant in Trade Association Organization and Management; F. G. Steinebach, Editor, *The Foundry*, Penton Publishing Co.; F. L. Plummer, Case School of Applied Science; J. C. Hodge, The Babcock & Wilcox Co.; James L. Wick, Jr., The Falcon Bronze Co.

Detroit District Committee—T. A. Boyd, General Motors Corp.; R. R. Johnston, E. I. du Pont de Nemours and Co., Inc.; J. W. Kennedy, Huron Portland Cement Co.; J. L. McCloud, Ford Motor Co.; W. P. Putnam, The Detroit Testing Laboratory.

Northern California District Committee—R. E. Davis, University of California; Theo. P. Dresser, Jr., Abbot A. Hanks, Inc.; Dennistoun Wood, Southern Pacific Co.; H. D. Dewell, Partner, Henry D. Dewell & Austin W. Earl.

Southern California District Committee—John Disario, Columbia Steel Co.; E. O. Slater, Smith-Emery Co.; G. A. Beckett, Riverside Cement Co.

Philadelphia District Committee—G. H. Clamer, The Ajax Metal Co.; Harold Farmer, The Philadelphia Electric Co.; N. L. Mochel, Westinghouse Electric and Manufacturing Co.; L. G. Wilson, Precision Thermometer and Instrument Co.

New York District Committee—W. H. Bassett, Jr., Anaconda Wire and Cable Co.; J. McE. Sanderson, American Cyanamid Co.; M. F. Skinker, Consolidated Edison Co. of New York; E. A. Snyder, Socony-Vacuum Oil Co.; R. M. Wilhelm, C. J. Tagliabue Manufacturing Co.

Pittsburgh District Committee—A. R. Ellis, Pittsburgh Testing Laboratory; J. O. Leech, Carnegie-Illinois Steel Corp.; F. N. Speller, National Tube Co.; Jerome Strauss, Vanadium Corporation of America; Eugene Ayres, Gulf Research Development Co.; J. S. Gregorius, Pittsburgh Plate Glass Co.; S. M. Phelps, Mellon Institute of Industrial Research.

A. S. T. M. BULLETIN

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AMERICAN SOCIETY FOR TESTING MATERIALS

No. 87 — August, 1937

Emeralds

MANY members will note the heading to this article and wonder what emeralds have to do with A.S.T.M. The point is that the recent annual meeting was the fortieth held by the Society and, in wedding parlance, the fortieth anniversary is signified by the emerald. Someone may ask what wedding the A.S.T.M. participated in and one such function might be the wedding of research and the standardization of specifications and tests for materials.

However, the purpose of this article is to go back forty years to the first annual meeting of the American Section of the International Society for Testing Materials held on August 27, 1898, at the Philadelphia Engineers' Club. There were two sessions—an afternoon session and an evening session. President Mansfield Merriman presided with Richard L. Humphrey as Secretary. At the evening session W. R. Webster opened the discussion on the subject, "The Relation of the International Association to Producers and Consumers," and Mr. Henning discussed the subject, "In What Manner Will the Adoption of Standard Specifications Improve Industrial Methods and Processes?"

There were approximately twenty-five members at the meeting. It is a far cry from the first to the fortieth annual meeting. In 1898 the attendance was 25; in 1937, 1523; in 1898 there were two sessions, in 1937 nineteen sessions and 198 committee meetings; in 1898, three or four technical items, 1937—over one hundred technical papers and reports. In 1937 we have 825 specifications and tests. Any organization to survive must of course make progress. The Society in all of the various phases of its work has made excellent progress in the face of numerous problems and difficulties which necessarily had to be overcome.

To what single factor is this remarkable progress due? Who will question that it has been due to the sustained interest of a large percentage of the members, and especially the officers and members of the various Society committees in doing their part by attending meetings, participating in discussion, offering helpful data and information, all aimed toward promoting knowledge of materials and developing standard specifications and test methods satisfactory to consumers, producers, and general interest alike?

A Message from Doctor White

THE Society has just finished its fortieth year of activities. During the past twelve months, it has been under the active leadership of Past-President Fieldner and his coworkers. May we pause, therefore, for a moment to express our appreciation for their wise and devoted leadership.

Culminating the year's work was the annual meeting in New York. A debt of gratitude is owed Past-President Vassar, Doctor Skinker, and those others who served on the New York Committee of Arrangements. Much credit is also due the Society's executive personnel and the various committees responsible for their share in the excellent program.

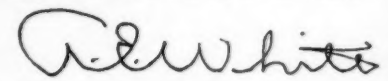
Beyond question the Exhibit was the finest ever held by the Society. It was most complete with respect to displays and testing equipment, arranged in unusually attractive booths.

The various papers on the program were of high order. It was also gratifying to note that the meetings were exceptionally well attended.

The report of the Executive Committee showed the Society to be in a most healthy condition. Its membership is nearly equal to the peak attained in 1930. Financially, it is considerably above the previous peak year. This is due to the large demand for the Society's publications; especially its Book of Standards and Book of Tentative Standards. This demand in itself is outstanding evidence of the value in service the Society is rendering in the field of engineering and industry.

Over 1600 members of the Society actively participate in the preparation of specifications and test methods, and other activities. Well may it be designated as a *working* Society with a special task for every member. In this feature lies its strength.

May the year that lies before us be one of continued service and progress.



President

Second-Class Mailing of Bulletin

BECAUSE of the growth of the BULLETIN, consideration has been given to the possibility and advantages of entering it as second class matter for mailing purposes, and it has been decided to make application to the Post Office Department. It will be noted from the inside front cover of this issue that the customary note in connection with this procedure appears. If the application is granted, it will mean that the BULLETIN will be placed on a subscription basis, a stated portion of the members' annual dues being alloted as the subscription price. Further announcements concerning this matter will be made.

In order to meet the Post Office Regulations concerning second class matter, it was necessary to date this issue of the BULLETIN August rather than July as has been the previous custom. It is planned that the mid-summer issue will come out in the future late in July or early in August, but will carry an August date.

Numerous Actions on Standards Referred to Letter Ballot

By action of the Fortieth Annual Meeting, 46 recommendations from the standing committees affecting standards and tentative standards were approved for submission to letter ballot of the Society membership. These recommendations comprise 21 tentative standards proposed for adoption as standards and the adoption as standard of revisions proposed in 25 existing standards. A complete list of the items to be voted upon appears in the letter ballot being sent in a separate mailing to the members. Detailed information concerning all matters referred to letter ballot is given in the committee reports issued in preprint form to the membership in advance of the meeting. The Summary of Proceedings accompanying the letter ballot contains a record of all actions taken at the annual meeting and also gives in full detail any changes in or additions to the standing committee recommendations as preprinted.

In addition to the actions on standards, several amendments of the By-laws are being referred to Society letter ballot. These changes, listed in the ballot, were given in detail in the preprint of the 1937 Annual Report of the Executive Committee, which also explained the reasons for the proposed amendments.

All members in good standing are urged to execute the ballot and vote on the matters on which they feel technically qualified to pass judgment.

New Committee Officers Elected

As the result of recent elections by certain standing committees of the Society, several new officers have been chosen. Committee A-1 on Steel at its New York meeting elected N. L. Mochel, Metallurgical Engineer, Westinghouse Electric and Manufacturing Co., as consumer vice-chairman, succeeding H. W. Faus, who was forced to relinquish his committee work because of a change in his duties. Committee B-5 on Copper and Copper Alloys chose as its new chairman, C. H. Greenall, Apparatus Development Dept., Bell Telephone Laboratories, Inc., succeeding Prof. C. H. Mathewson, and C. H. Davis, Metallurgist, The American Brass Co., was elected secretary to succeed D. K. Crampton. Messrs. Mathewson and Crampton have been officers of the committee for a number of years and wished to relinquish their duties.

Committee E-3 on Chemical Analysis of Metals, electing a vice-chairman for the first time, chose C. B. Francis, Metallurgical Dept., Carnegie-Illinois Steel Corp.

The officers of the three new committees which were organized during the annual meeting and the new officers of the committee resulting from the consolidation of C-3 on Brick and C-10 on Hollow Masonry Building Units are listed in connection with separate articles in this BULLETIN.

Mistakes

When a plumber makes a mistake he charges double for it.
When a lawyer makes a mistake, it means more business.
When a doctor makes a mistake, he buries it.
When a judge makes a mistake, it becomes the law.
When a preacher makes a mistake, nobody knows the difference.
But when an editor makes a mistake, good night!

Our Growing Membership

Once again the annual report of the Executive Committee records the encouraging growth of Society membership at accelerated pace during the past year. On June 1, 1937, the membership was 3992, a net gain for the year of 251. Corresponding figures for the two preceding years were 129 and 43. Elections to membership have continued to increase, being 454 for this year compared to 334 and 319 for the past two years. Losses from resignations and delinquencies were the lowest for many years, 177. If the present rate of growth is maintained, the membership at the close of the year may cross the 4100 mark, which would bring us within about 300 of the all time "pre-depression" high of 4417 members on December 31, 1930.

And, this growth will be maintained if we continue to have the splendid support for new membership work that has been given during the past year. Many suggestions of companies and individuals who should be interested in A.S.T.M. work and who should find it of benefit have been given by numerous members. Many others affiliated with the Society have assisted by following up invitations that were extended and in other ways. Several of the District Committees have sponsored special efforts to enlist the interest of membership prospects, asking all of the members in the district to cooperate.

All of these efforts have contributed to the very favorable growth, and each member is urged to assist in any way that he can. With the sustained efforts of the members and District Committees, we can continue to make excellent progress.

Symposium on Lubricants Published

The Symposium on Lubricants which was held during the Chicago Regional Meeting this year under sponsorship of Technical Committee B on Motor Oils of A.S.T.M. Committee D-2 on Petroleum Products and Lubricants will be issued shortly in the form of a special publication comprising 100 pages. This includes the four extensive technical papers covering engine deposits, automotive bearings, addition agents, and selection of motor oil from the standpoint of the consumer, and there has also been included much of the pertinent and interesting discussion on the respective papers.

This symposium is a sequel to the 1933 symposium for which there has been a very widespread demand.

In a separate mailing there is being sent to each member a special order blank enabling him to order copies of the book at the special members' price, 75 cents in heavy paper binding, $1 in blue cloth. The prices to non-members are $1.25 and $1.50 respectively.

Discussion of Meeting Papers

Written discussion of the papers and reports presented at the 1937 annual meeting will be received by the Committee on Papers and Publications until September 1. All who plan to submit discussion are urged to send it to Society Headquarters as far in advance of the closing date as possible in order to facilitate the preparation of the material for the Proceedings.

67 New and Revised Tentative Standards

Largest Number Yet Approved

THE Society accepted at the annual meeting 51 new tentative standards and revisions of 46 existing tentative specifications and methods of test. Of the new tentative standards, 39 represent additions to the standardization list, 12 are revisions of existing standards. Sixteen of the 46 revised tentative specifications and test methods represent extensive modifications. The titles of these are included below with the list of those issued by the Society for the first time. Standing committees responsible for the various items are indicated in italics. The number of new tentative standards is the largest that has ever been approved at an annual meeting.

Ferrous Metals

Specifications for:

Seamless Cold-Drawn Intermediate Alloy-Steel Heat-Exchanger and Condenser Tubes (A 199 – 37 T). *Committee A-1 on Steel.*

Seamless Intermediate Alloy-Steel Still Tubes for Refinery Service (A 200 – 37 T). *Committee A-1.*

Carbon-Silicon-Steel Plates of Ordinary Tensile Ranges for Fusion-Welded Boilers and Other Pressure Vessels (A 201 – 37 T). *Committee A-1.*

Chrome-Manganese-Silicon (CMS) Alloy-Steel Plates for Boilers and Other Pressure Vessels (A 202 – 37 T). *Committee A-1.*

Low-Carbon-Nickel Steel Plates for Boilers and Other Pressure Vessels (A 203 – 37 T). *Committee A-1.*

Molybdenum-Steel Plates for Boilers and Other Pressure Vessels (A 204 – 37 T). *Committee A-1.*

Iron and Steel Filler Metal (Arc-Welding Electrodes and Gas-Welding Rods) (A 205 – 37 T). *Committee A-1.*

Zinc-Coated (Galvanized) Iron or Steel Farm-Field and Railroad Right-of-Way Wire Fencing (A 116 – 37 T) (revision of standard). *Committee A-5 on Corrosion of Iron and Steel.*

Zinc-Coated (Galvanized) Iron or Steel Barbed Wire (A 121 – 37 T) (revision of standard). *Committee A-5.*

Non-Ferrous Metals

Specifications for:

Rolled Zinc (B 69 – 37 T) (revision of standard). *Committee B-2 on Non-Ferrous Metals and Alloys.*

Copper and Copper-Alloy Seamless Condenser Tubes and Ferrule Stock (B 111 – 37 T) (revision of standards). *Committee B-5 on Copper and Copper Alloys, Cast and Wrought.*

Aluminum-Base Alloys in Ingot Form for Permanent Mold Castings (B 112 – 37 T). *Committee B-7 on Light Metals and Alloys, Cast and Wrought.*

Aluminum-Base Alloys in Ingot Form for Sand Castings (B 58 – 37 T). *Committee B-7.*

Cement

Method of:

Test for Compressive Strength of Portland-Cement Mortars (C 109 – 37 T). *Committee C-1 on Cement.*

Brick

Specifications for:

Paving Brick (C 7 – 37 T) (revision of standard). *Committee C-3 on Brick.*

Sewer Brick (Made from Clay or Shale) (C 32 – 37 T) (revision of standard). *Committee C-3.*

Building Brick (Made from Clay or Shale) (C 62 – 37 T) (revision of standard). *Committee C-3.*

Concrete and Concrete Aggregates

Specifications for:

Concrete Units for Non-Load-Bearing Masonry, and Methods of Test for (C 129 – 37 T). *Committee C-10 on Hollow Masonry Building Units.*

Lightweight Aggregate for Concrete (C 130 – 37 T). *Committee C-9 on Concrete and Concrete Aggregates.*

Method of:

Test for Abrasion of Coarse Aggregate by Use of the Los Angeles Machine (C 131 – 37 T). *Committees C-9 and D-4 on Road and Paving Materials.*

Test for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate (C 88 – 37 T). *Committee C-9.*

Refractories

Methods of:

Test for Cold Crushing Strength and Modulus of Rupture of Refractory Brick and Shapes (C 133 – 37 T). *Committee C-8 on Refractories.*

Chemical Analysis of Refractory Materials (C 18 – 37 T) (revision of standard). *Committee C-8.*

Definitions of:

Terms Relating to Alumina-Diaspore Refractories (C 71 – 37 T). *Committee C-8.*

Fire Tests

Specifications for:

Fire-Retardant Properties of Wood for Scaffolding and Shoring (C 132 – 37 T). *Committee C-5 on Fire Tests of Materials and Construction.*

Pigments and Paint

Specifications for:

Basic Sulfate White Lead (D 82 – 37 T) (revision of standard). *Committee D-1 on Paint, Varnish, Lacquer and Related Products.*

Titanium-Magnesium Pigment (D 442 – 37 T). *Committee D-1*

Zinc Sulfide Magnesium Pigment (D 443 – 37 T). *Committee D-1.*

Methods of:

Routine Analysis of Zinc Yellow Pigment (Zinc Chromate Yellow) (D 444 – 37 T). *Committee D-1.*

Routine Analysis of Dry Cuprous Oxide (D 283 – 37 T) (revision of standard). *Committee D-1.*

Test for Spectral Apparent Reflectivity of Paints (D 307 – 37 T) (revision of standard). *Committee D-1.*

Test for Relative Dry Hiding Power of Paints (D 344 – 37 T). *Committee D-1.*

Test for Relative Dry Hiding Power of White Pigments (D 406 –37 T). *Committee D-1.*

Naval Stores

Methods of:

Test for Acid Number of Rosin (D 464 – 37 T). *Committee D-17 on Naval Stores.*

Test for Saponification Number of Rosin (D 465 – 37 T). *Committee D-17.*

Petroleum Products and Lubricants

Methods of:

Test for Kinematic Viscosity (D 445 – 37 T). *Committee D-2 on Petroleum Products and Lubricants.*

Conversion of Kinematic Viscosity to Saybolt Universal Viscosity (D 446 – 37 T). *Committee D-2.*

Test for Distillation of Plant Spray Oils (D 447 – 37 T). *Committee D-2.*

Test for Vapor Pressure of Petroleum Products (Reid Method) (D 323 – 37 T). *Committee D-2.*

Viscosity-Temperature Chart for Liquid Petroleum Products (D 341 – 37 T) (Includes four viscosity-temperature charts, two for kinematic viscosity and two for Saybolt Universal viscosity conversions). *Committee D-2.*

Road Materials

Specifications for:

Standard Sizes of Coarse Aggregate for Highway Construction (D 448 – 37 T). *Committee D-4 on Road and Paving Materials.*

Methods of:

Test for Abrasion of Gravel by Use of the Deval Machine (D 289 – 37 T). *Committee D-4.*

Waterproofing and Roofing Materials

Specifications for:

Asphalt for Damp-proofing and Waterproofing (D 449 – 37 T). *Committee D-8 on Bituminous Waterproofing and Roofing Materials.*

Coal-Tar Pitch for Roofing, Damp-Proofing and Waterproofing (D 450 – 37 T). *Committee D-8.*

Asphalt Cap Sheet Surfaced with Coarse Mineral Granules (D 371 – 37 T). *Committee D-8.*

Creosote for Priming Coat with Coal-Tar Pitch in Damp-Proofing and Waterproofing (D 43 – 37 T). *Committee D-8.*

Methods of:

Test for Sieve Analysis of Granular Mineral Surfacing for Asphalt Roofing and Shingles (D 451 – 37 T). *Committee D-8.*
Test for Sieve Analysis of Non-Granular Mineral Surfacing for Asphalt Roofing and Shirgles (D 452 – 37 T). *Committee D-8.*
Testing Asphalt Roll Roofing, Cap Sheets, and Shingles (D 228 – 37 T). *Committee D-8.*
Test for Coarse Particles in Mixtures of Asphalt and Mineral Matter (D 313 – 37 T). *Committee D-8.*

COAL

Methods of:

Drop Shatter Test for Coal (D 440 – 37 T). *Committee D-5 on Coal and Coke.*
Tumbler Test for Coal (D 441 – 37 T). *Committee D-5.*
Test for Grindability of Coal by the Ball-Mill Method (D 408 – 37 T). *Committee D-5.*
Test for Grindability of Coal by the Hardgrove-Machine Method (D 409 – 37 T). *Committee D-5.*

TIMBER PRESERVATIVES

Method of:

Test for Tar Acids in Creosote and Creosote-Coal Tar Solutions (D 453 – 37 T). *Committee D-7 on Timber.*

ELECTRICAL INSULATING MATERIALS

Methods of:

Test for Insulation Resistance of Electrical Insulating Materials (D 257 – 37 T) (revision of standard). *Committee D-9 on Electrical Insulating Materials.*
Testing Flexible Varnished Tubing Used for Electrical Insulation (D 350 – 37 T). *Committee D-9.*

RUBBER PRODUCTS

Method for:

Air Pressure Heat Test of Vulcanized Rubber (D 454 – 37 T). *Committee D-11 on Rubber Products.*

TEXTILE MATERIALS

Methods of:

Test for Wool Felt (D 461 – 37 T). *Committee D-13 on Textile Materials.*
Testing and Tolerances for Certain Wool and Part Wool Fabrics (D 462 – 37 T). *Committee D-13.*
Test for Volumetric Determination of Small Amounts of Copper in Textiles (D 463 – 37 T). *Committee D-13.*

SOAPS AND DETERGENTS

Specifications for:

Milled Toilet Soap (D 455 – 37 T). *Committee D-12 on Soaps and Detergents.*
Caustic Soda (D 456 – 37 T). *Committee D-12.*
Modified Soda (Sesquicarbonate Type) (D 457 – 37 T). *Committee D-12.*
Soda Ash (D 458 – 37 T). *Committee D-12.*

Methods of:

Sampling and Chemical Analysis of Soaps and Soap Products (D 460 – 37 T). *Committee D-12.*

Definitions of:

Terms Relating to Soaps and Detergents (D 459 – 37 T). *Committee D-12.*

1937 Year Book Sent on Request

ALL members of the Society who wish to obtain a copy of the 1937 Year Book (now in preparation) should return promptly the request card being sent in a separate mailing. Copies of the Year Book will be sent only on request.

As customary, the 1937 edition will contain the complete membership list. The committee section, listing the full personnel and officers of all A.S.T.M. standing committees will be included, as well as the By-laws, Regulations Governing Standing Committees, Society representatives, etc.

Wire Inspection Committee Appointed

THE 1937 report of Committee A-5 on Corrosion of Iron and Steel includes a report of the Wire Test Committee and an extensive appendix details the types of materials tested, the number of samples to be exposed, information on the eleven test locations and other data. The referee testing of all materials exposed in the test have been begun at the National Bureau of Standards and when the complete data have been obtained a supplement will be published so that complete information on all materials will be available in the Society publications. When these data are issued the work of the original wire test committee will have been completed and the inspection of the materials, publication of the inspection data and conclusions drawn from these country-wide tests, which involve almost 11,000 test specimens aggregating almost ten miles of plain wire, barbed wire, strand, farm fence, and chain-link fence, will be the responsibility of the Wire Test Inspection Committee. This inspection committee has just been appointed and consists of the following members:

C. D. Hocker, *Chairman,* Bell Telephone Laboratories, Inc.
S. A. Braley, Pittsburgh Steel Co.
F. M. Crapo, Indiana Steel and Wire Co.
F. C. Elder, American Steel and Wire Co.
E. V. Gent (C. C. Bartells, Alternate), American Zinc Institute
W. H. Finkeldey, Singmaster & Breyer
F. V. Hammel, Whitall Tatum Co.
H. H. Harman, Bessemer and Lake Erie Railroad
L. W. Hopkins, American Chain and Cable Co., Inc. (J. J. Maher, Alternate, Page Steel and Wire Co.)
B. A. Jennings, Cornell University
C. A. Kellogg, Continental Steel Corp.
R. F. Passano, American Rolling Mill Co.
H. S. Phelps, Philadelphia Electric Co.
H. S. Rawdon, National Bureau of Standards
R. S. Simmons, Keystone Steel and Wire Co.
H. E. Smith, Materials Engineer
L. H. Winkler (J. L. Gregg, Alternate), Bethlehem Steel Co.

The primary purpose of these tests is to determine the effect of such factors as base-metal composition, gage, type of coating, weight of coating, etc., on the serviceability of zinc-coated strand, barbed, and woven wire fencing and unfabricated wire.

The Wire Test Committee has decided that no particular end point shall be sought in determining the serviceability of test specimens. It is felt that a rather complete picture of the deterioration of the samples, including extent of rusting, change in tensile properties and weight of coating, and decrease in cross-section of wires will furnish information suitable for predicting serviceability of the products.

Instructor and Graduate Assistants

THE Mechanical Engineering Department of the Oregon State College at Corvallis, Oregon, requires an instructor and two graduate assistants for service beginning October 1. The instructor should have a mechanical engineering background with some special training and experience in materials testing and metallography. Age not over 28 years. Graduate assistants should have the Bachelor's degree in Mechanical Engineering from a recognized school and will be candidates for the Master's degree giving approximately half-time service. Interested eligibles may communicate directly with S. H. Graf, Professor of Mechanical Engineering.

New Committee on Paper and Paper Products Organized

Meeting Held in New York City

At a meeting held during the 1937 annual meeting in New York City a new standing committee on paper and paper products was formally organized. Officers were elected and various phases of projected work of the committee were reviewed. Roger C. Griffin, Director of Tests, Arthur D. Little, Inc., who had served as temporary chairman, presided at the meeting and explained the various steps leading to the organization of the new committee which has been assigned the designation D-6. The meeting was well attended with many of the members of the new committee, and visitors and guests interested in the work, present.

Various announcements have appeared from time to time concerning the progress of the organization of this committee which was authorized by the Executive Committee sometime ago. A number of problems remained to be worked out before formal organization could be effected.

SCOPE OF THE COMMITTEE

There was considerable discussion at the meeting concerning the proposed statement of scope which had been drafted. This is as follows:

Scope.—(a) The study, review and adoption of general paper testing methods.

(b) The preparation of definitions of terms, nomenclature, etc.

(c) The interpretation of results obtained from tests of paper in terms of their applicability to use requirements.

(d) Investigation of the need of specifications in various specialty fields and the preparation of specifications for paper and paper products in those fields for which there is need—this to include the development of any specific methods of test that may be needed.

Action was taken to refer this statement to the Advisory Committee for consideration of certain points which were raised at the meeting.

PERSONNEL

The work of the committee is to be directed by an Advisory Committee which in addition to the three committee officers and four subcommittee chairmen indicated below will consist of three additional members. Acting on the report of the nominating committee, the following officers were elected:

Chairman: R. C. Griffin, Director of Tests, Arthur D. Little, Inc.
Vice-Chairman: M. A. Krimmel, Assistant Director of Laboratories, Hammermill Paper Co.
Secretary: L. S. Reid, Technician, Standardization Laboratory, Metropolitan Life Insurance Co.

In addition to Messrs. W. E. Emley, C. C. Heritage, R. M. Bates and Don L. Quinn, subcommittee chairmen, the following three men were elected as members of the Advisory Committee: W. R. Maull, Vice-President, Dill & Collins Co. (representing T.A.P.P.I on the committee); Edward Dahill, Chief Engineer, Freight Container Bureau, Association of American Railroads; and G. H. Harnden, General Electric Co.

The committee as appointed by the Society is made up of representatives of a number of organizations concerned with the paper field and leading technologists will take part in the activities. The personnel of the committee at present consists of the following:

PERSONNEL OF COMMITTEE D-6

American Can Co., C. A. Enright
American Cyanimid Co., R. W. Lahey
R. M. Bates, Thomas M. Royal Co.
Bird and Son, Inc., R. A. Wilkins
T. A. Carlson, U. S. Forest Products Laboratory
Container Corp. of America, J. J. Brossard, C. P. Barker
Continental-Diamond Fibre Co., G. S. Landt
Electrical Testing Laboratories, P. F. Wehmer
W. E. Emley, National Bureau of Standards
Freight Container Bureau, American Association of Railroads, E. Dahill
Robert Gaylord, Inc., H. L. Bode
General Electric Co., R. L. Beach, G. H. Harnden
A. H. Greenly, Freight Classification Committee of I.C.C.
C. C. Heritage, Wood Conversion Co.
Helen W. Kiely, American Writing Paper Co.
M. A. Krimmel, Hammermill Paper Co.
Arthur D. Little, Inc., R. C. Griffin, R. W. McKinley
A. W. Luhrs, Container Testing Laboratories
J. D. Malcolmson, Robert Gair Co.
John A. Manning Paper Co., E. G. Ham
Marathon Paper Mills, Allen Abrams
P. W. McCready, University of Michigan
Montgomery Ward and Co., Inc., J. N. Hamilton
National Association of Purchasing Agents, J. M. Berry
National Bureau of Standards, C. G. Weber
Don L. Quinn, The Don L. Quinn Co.
L. S. Reid, Metropolitan Life Insurance Co.
H. J. Skinner, Skinner and Sherman
R. F. Taber, Taber Instrument Co.
Technical Association of the Pulp and Paper Industry, W. R. Maull
U. S. Forest Products Laboratory, C. E. Curran
U. S. Government Printing Office, M. S. Kantrowitz
U. S. Gypsum Co., G. S. Willey
B. S. Van Zile, Colgate-Palmolive-Peet Co.
Western Electric Co., G. J. Behnke
Whitehall Cement Mfg. Co., M. H. Meighan

SUBCOMMITTEE ORGANIZATION

The preliminary steps which had been taken for the organization of subcommittees to work in four specific fields was discussed at the meeting. The subcommittees and the chairmen who will direct their work are as follows:

Subcommittee I on Paper Testing Methods—W. E. Emley, chairman
Subcommittee II on Significance of Test Methods—C. C. Heritage, chairman
Subcommittee III on Multi-Wall Paper Bags—R. M. Bates, chairman
Subcommittee IV on Paper Shipping Containers—Don L. Quinn, chairman

The subcommittee on paper testing methods plans to carefully consider the testing methods which have been developed by the Technical Association of the Pulp and Paper Industry and will undertake the development of other standard test methods which may be required by the subcommittees in their work. In discussing the work of his subgroup, Mr. Heritage indicated that it could be considered from four angles: (1) empirical tests of paper and paper products; (2) fundamental composition or constituent of paper and paper board involving nature of the structure and composition; (3) significance of tests largely used in guiding plant operations; and (4) uniformity of the product. The latter, it was indicated, may be quite different from the other three.

Various phases of the work of the subcommittee on multi-wall paper bags were reviewed and the meeting was informed concerning the previous organization of the subcommittee on shipping containers. This subcommittee was organized in March during A.S.T.M. Committee Week in order to start active work on the comprehensive program confronting it. It is expected that questions of uniformity and temperature control during testing, the significance of moisture content and its relationship to strength properties will receive the early attention of the committee.

Committee on Plastics Formally Organized

Personnel, Scope, etc., Approved at New York Meeting

ANNOUNCEMENTS have appeared in previous BULLETINS concerning the decision to organize a new A.S.T.M. standing committee on plastics. Formal organization of the committee was consummated at a meeting held in New York City during the A.S.T.M. annual meeting at which W. E. Emley, National Bureau of Standards, who was serving as temporary chairman, presided.

In his remarks opening the meeting Mr. Emley pointed out that the work previously done by the Society in this field covered tests for electrical plastics, this work being in the charge of Committee D-9 on Electrical Insulating Materials, and that since plastic materials were being used extensively in many fields other than electrical insulation, it was felt the Society should proceed immediately with the organization of a new committee and start work to meet the need for study of test methods and the development of standard test requirements.

SCOPE OF COMMITTEE

After discussion of a proposed statement of scope for the new committee, to which has been assigned the designation Committee D-20, the following statement was approved:

Scope.—The work of this committee shall be confined, with the limitations noted hereafter, to the development of testing methods applicable to finished products in the field of plastics.

Plastics enter into commerce in three forms: as molding powders; as standard shapes, such as sheets, rods, and tubes; and as molded articles. Each of these three forms is a finished product in so far as a part of the industry is concerned. While it may be found that a testing method applicable to one form will not be suitable for another form, the committee should develop methods for all three forms, the methods for the different forms being the same as far as practicable.

Plastics entering into the paint and varnish industry and plastics entering into the rubber industry are not within the field of work of this committee.

Methods for measuring the electrical properties of plastics are not within the field of work of this committee.

The above statement of scope was accepted with the understanding that a more concise statement would be published in the Year Book, this statement to appear as follows:

Scope.—The scope of the committee shall be the development of test methods applicable to the finished products (molding materials, sheets, tubes and rods, and molded or fabricated articles) in the field of plastics.

Note.—From this list should be excluded electrical tests, and plastics used in the paint industry and rubber industry, which are covered by other committees.

OFFICERS AND PERSONNEL

As a result of the election at the meeting, the following officers were chosen to direct the work of the committee:

Chairman: W. E. Emley, Chief, Division of Fibrous and Organic Materials, National Bureau of Standards

First Vice-Chairman: Bjorn Andersen, Technical Director, Celluloid Corp.

Second Vice-Chairman: T. Smith Taylor, Manager, Engineering Laboratory and Experiment Dept., Diehl Manufacturing Co.

Secretary: W. A. Evans, Telephone Engineer, Bell Telephone Laboratories, Inc.

Many of the leading companies and technologists concerned with this field will serve as members of the committee, the personnel at this time being made up as follows:

PERSONNEL OF COMMITTEE D-20

American Insulator Corp., B. H. Bowlus
F. O. Anderegg, Owens-Illinois Glass Co.
W. F. Bartoe, Rohm and Haas
E. C. Bingham, National Bureau of Standards
R. M. Boehm, Masonite Corp.
Carbide and Carbon Chemicals Corp., H. L. Cox
Celluloid Corp., Bjorn Andersen
A. B. Cummins, Johns-Manville Corp.
W. E. Emley, National Bureau of Standards
Gustavus J. Esselen, Gustavus J. Esselen, Inc.
W. A. Evans, Bell Telephone Laboratories, Inc.
The Fibreloid Corp., E. A. Wilson
Formica Insulation Co., J. C. Pitzer
Ephraim Freedman, R. H. Macy and Co.
General Electric Co., H. M. Richardson, J. R. Hiltner (laminated plastics), F. W. Warner (molded plastics)
General Plastics, Inc., R. M. Crawford
G. M. Kline, National Bureau of Standards
W. R. Koch, Air Corps, U.S.A.
Charles Lichtenberg, Commercial Solvents Corp.
National Carbon Co., L. M. Currie
Otis Elevator Co., M. P. Davis
H. W. Paine, E. I. du Pont de Nemours and Co.
Pittsburgh Plate Glass Co., E. L. Fix
Plaskon Co., A. M. Howald
Radio Manufacturers Assn., A. P. Berejkoff
S. G. Saunders, Dodge Brothers Corp.
T. Smith Taylor, Diehl Mfg. Co.
Tennessee Eastman Corp., C. H. Penning, L. W. A. Meyer
Ternstedt Manufacturing Div., General Motors Corp., C. F. Nixon
U. S. Bureau of Chemistry and Soils, P. H. Groggins
U. S. Navy, Officer-in-Charge, Specification Section, Design Division, Bureau of Engineering, Washington, D. C.
Westinghouse Electric and Manufacturing Co., R. H. Cunningham
E. R. Perry
W. A. Zinzow, Bakelite Corp.

A number of suggestions for additional members were made at the meeting and are receiving consideration.

SUBCOMMITTEES

After considering proposed activities of the committee, five committees were decided upon and chairmen were appointed as follows:

Subcommittee I on Strength Properties—H. M. Richardson
Subcommittee II on Hardness Properties—J. C. Pitzer
Subcommittee III on Thermal Properties—L. M. Currie
Subcommittee IV on Optical Properties—H. W. Paine
Subcommittee V on Permanence Properties—G. M. Kline

As one of its first important projects, the committee accepted the responsibility of preparing for a Symposium on Plastics which is to be held as the technical feature of the 1938 Regional Meeting to be held in Rochester.

It is of interest to note in connection with the completion of the organization of Committee D-20 on Plastics that a feature of last year's annual meeting was an address by Doctor Parmelee, Editor, *Engineering and Mining Journal*, on "Relationship of Some Modern Chemical Engineering Developments to the Work of A.S.T.M." referring especially to some of the major developments in the field of plastics. The Twelfth Edgar Marburg Lecture referred to in the article in this issue of the BULLETIN on the annual meeting was presented by Dr. T. Smith Taylor on the sub-

ject: "Plastics: Some Applications and Methods of Testing." As has been pointed out in issues of the *Technical News Bulletin* of the National Bureau of Standards, developments in modern plastics have been described as an outstanding feat of modern science, particularly the manufacture of some of the colorful plastics entirely from gases in the atmosphere. Plastics are serving in a variety of fields—radio housings, telephone sets, electrical devices, clock cases, table accessories, etc., lamp shades, pen and pencil sets and the like. In laminated form plastics are finding applications in many architectural and constructional lines and various technologists have pointed out that the use of plastics in many forms may be expected to increase rapidly. The organization of Committee D-20 is significant of the need for standardization work in this field.

Standard Samples of Materials

THE preparation and maintenance of standard samples of materials for use in checking methods of analysis and test has been carried on for many years by the National Bureau of Standards. Nearly all of these samples are applicable to one or more A.S.T.M. methods. There are, however, a number of materials for which the Society has written standard methods of analysis that are not represented in the Bureau's list of standard samples. In many of these cases standard samples are not considered necessary; in others technical difficulties or lack of required funds have stood in the way of establishing a standard sample.

A study of the part the Society might properly take in the development of additional samples has been made by the Executive Committee during the past year. As an important step in this study, the standing committees were asked, first, whether the standard samples that have so far been prepared by the Bureau are adequate and satisfactory with respect to the materials in which the committees are interested; second whether there are any materials of interest to the committees for which standard samples have not been prepared by the Bureau; and third, if so, whether the committees will be prepared to lend their support and that of their members in aiding the Bureau to establish such standards. The returns from this questionnaire showed that about twenty committees are interested in standard samples. There was very general agreement that the present samples are satisfactory, and a number of suggestions for new standard samples were made with offers of cooperation from certain of the committees.

This study has led the Executive Committee to formulate the following broad policies to guide the Society and its committees in further development of standard samples:

There is evidence that the existing standard samples such as established by the National Bureau of Standards serve a useful purpose, and that there is a substantial demand for additional samples. However, it is not a proper function of the Society to be directly instrumental in extending the list. The Society will in general look to the Bureau of Standards for the development of such standard samples and is prepared to cooperate with the Bureau in this activity.

The demand for such standard samples should come from the individual committees concerned. Preliminary negotiations looking into the feasibility of the standard should be between the standing committees and the Bureau, confirmed by the Secretary-Treasurer after agreement has been reached with the Bureau.

It will be necessary for each committee to provide the material for each sample.

It is desirable wherever standard samples are available that mention be made of this fact in connection with any A.S.T.M. methods of analysis or test where they are applicable. This type of reference could also be supplemented with complete lists of standard samples available, wherever the publication of such list seems to be appropriate.

The Bureau of Standards has given its assurance that it will welcome the help of the Society in this work. The Executive Committee has asked the Bureau to review a list of materials for which standard samples are suggested in the replies to the above-mentioned questionnaire, and to propose a limited number of materials for which the Bureau believes it is both desirable and feasible to provide standard samples. The cooperation of the appropriate committee of the Society will then be sought to aid in the establishment of such new samples.

One project of this character is already under way, namely, the establishment of a reference sample of silica brick for specific gravity determinations, in which Committee C-8 on Refractories and Committee E-1 on Methods of Testing are cooperating with the Bureau.

Manufacture of Ubbelohde Viscosimeter Licensed

THE Executive Committee of the Society has approved a form of license agreement under which the Fish-Schurman Corp., New York City, will license the manufacture and sale of the Ubbelohde viscosimeter, which is one of several types of instruments specified in the Tentative Methods of Test for Kinematic Viscosity (D 445 - 37 T) accepted by the Society at the recent annual meeting upon the recommendation of Committee D-2 on Petroleum Products and Lubricants. This is a suspended level viscosimeter upon which Dr. Leo Ubbelohde of Germany was granted U. S. Patent No. 2048305 on July 21, 1936. The Fish-Schurman Corp. is the American representative of Doctor Ubbelohde and authorized to grant licenses under the patent. The agreement provides for a non-exclusive license, stipulates a maximum royalty for each instrument manufactured under the license, and requires that each viscosimeter shall fully meet such A.S.T.M. standards or tentative standards relating thereto as are current at the time the viscosimeter is sold and shall be marked with the A.S.T.M. designation identifying such standard.

Members may obtain further information respecting this agreement by addressing a communication to the Secretary-Treasurer of the Society.

C. L. Hippensteel Seriously Ill

C. L. HIPPENSTEEL, Member of the Technical Staff, Bell Telephone Labs., who is very active in numerous phases of Society work, a member of Committee E-6 on Papers and Publications, and chairman of Subcommittee VIII on Galvanic and Electrolytic Corrosion of the Society's Committee B-3 on Corrosion of Non-Ferrous Metals and Alloys, this being one of his most important Society responsibilities, has been seriously ill for several months and his condition continues to be grave. The staff of physicians in attendance is doing everything possible to expedite his recovery. Several blood transfusions have been given, donors being associates and friends. His many friends in the Society are earnestly hoping that he may soon show definite signs of improvement.

Committee on Glass Organized

Standard Tests to Be Developed

PREVIOUS announcements have been made concerning the suggestions of the Glass Division of the American Ceramic Society that A.S.T.M. organize a new standing committee on glass and glass products. It was pointed out that this committee had been authorized by the Executive Committee and that a preliminary conference on the subject was held in Pittsburgh early in January. The new standing committee, C-14 on Glass and Glass Products, was formally organized at a meeting held during the Fortieth Annual Meeting, New York City and will provide in accordance with long-established procedure an opportunity of bringing together producers, consumers and general interest groups for the purpose of developing American standards for the testing of glass and glass products.

The temporary chairman and secretary of the committee, G. W. Morey, Geophysical Laboratory, Carnegie Institution of Washington, Washington, D. C., and Lewis Navias, General Electric Co., Schenectady, N. Y., respectively, had charge of the meeting. The Steering Committee which worked with these men in making plans for the organization and initiation of the committee's work, as announced in the January BULLETIN, included representatives of major organizations concerned with glass.

SCOPE AND PERSONNEL OF COMMITTEE

The scope which was recommended for the committee was approved. This is as follows:

Scope.—The development of nomenclature and methods for analysis and testing of glass, both as such and as specific products.

The committee decided that the executive direction of the work would be in the charge of three officers and an advisory committee which would include in addition to the officers, four other members. The election of officers resulted in the selection of Doctor Morey as chairman, Mr. Navias as secretary and F. C. Flint as vice-chairman. Members of the Advisory Committee who were elected are Messrs. J. C. Hostetter, J. T. Littleton, A. N. Finn and G. M. Rapp.

The personnel of the committee is made up of prominent technologists in the industry representing producers and consumers, and in addition a number of general interests. A list of the personnel at this time follows:

PERSONNEL OF COMMITTEE C-14

American Ceramic Society, Inc., J. C. Hostetter
American Pharmaceutical Assn., E. F. Kelly
The Austin Co., Albert S. Low
Bell Telephone Laboratories, Inc., K. G. Coutlee
Corning Glass Works, H. H. Blau, J. T. Littleton, W. C. Taylor
R. B. Crepps, Purdue University
Electrical Testing Laboratories, W. F. Little
A. N. Finn, National Bureau of Standards
F. C. Flint, Hazel-Atlas Glass Co.
General Electric Co., Louis Navias
General Motors Corp., H. R. Wolf
J. F. Greene, Kimble Glass Co.
Hartford-Empire Co., D. E. Sharp, H. A. Wadman
C. E. Heussner, Chrysler Corp.
International Association of Milk Dealers, R. E. Little
G. E. F. Lundell, National Bureau of Standards
Maryland Glass Corp., W. R. Lester
G. W. Morey, Geophysical Laboratory, Carnegie Institution of Washington
New York State College of Ceramics, S. R. Scholes
Owens-Illinois Glass Co., U. E. Bowes, J. H. Waggoner
Pittsburgh Plate Glass Co., J. S. Gregorius
Pittsburgh Testing Laboratory, M. L. Carr
G. M. Rapp, Port of New York Authority
J. P. Staples, Pittsburgh Corning Corp.
E. W. Tillotson, Mellon Institute of Industrial Research
U. S. War Dept., O. K. Kaspereit, C. W. Kendall
R. W. Wampler, Libbey-Owens-Ford Glass Co.
Westinghouse Electric and Manufacturing Co., C. F. Hill, H. K. Richardson
Whitall Tatum Co., J. L. Bacon, G. E. Barton

After considering various problems which it was felt the committee should attack, it was decided to appoint six subcommittees. These groups and the respective chairmen are as follows:

I. Nomenclature and Definitions—G. W. Morey.
II. Chemical Analysis—G. E. F. Lundell.
III. Chemical Properties—D. E. Sharp.
IV. Physical and Mechanical Properties—J. T. Littleton.
V. Thermal Properties—E. W. Tillotson.
VI. Glass Construction Block and Tile—J. P. Staples.

In connection with the organization of this committee, members will recall that at a meeting sponsored by the Pittsburgh District Committee in February, three papers were presented on recent developments in the glass industry, laminated glass and glass fibers, these papers being printed in the March BULLETIN. In the paper on "Recent Advances in the Glass Industry" some of the progress made in a general way and in special fields was outlined, the influence of chemistry and physics was discussed and new uses and types of glass were described, including tempered glass, spun glass, glass building blocks and tiles, the sealing of glass to metal and the fabrication of large masses of glass.

Discussion on Lubricants—London

THE Council of the Institution of Mechanical Engineers (Great Britain) is organizing a "General Discussion on Lubrication and Lubricants" to be held in London in October. The tentative outline provides for a series of some 100 papers to be presented in a two-day meeting.

The program tentatively provides for papers under four general groups as follows: Journal and Thrust Bearings, Engine Lubrication, Industrial Applications, and Properties and Testing, each of these groups being subdivided into several main sections. Under the subgroup on Properties and Testing are such topics as friction and wear tests; physical properties and tests such as viscosity, density, volatility, pour point, surface condition tests; and chemical properties and tests.

A large number of individuals have been invited to present papers including several in the United States. The discussion has been brought to the attention of A.S.T.M. Committee D-2 on Petroleum Products and Lubricants and a definite expression of interest in the program has been indicated by the committee.

Semi-Annual Report of the Joint Research Committee on Boiler Feedwater Studies

THE Joint Research Committee on Boiler Feedwater Studies is now engaged in three specific studies and has under consideration a fourth project.

The one of these which has received the most widespread attention is that under the direction of Subcommittee VI on the Effect of Solution Composition on the Cracking of Boiler Metal, the chairman of which is Mr. J. H. Walker. The research project of this committee has concerned the problem of caustic embrittlement. As the result of certain disclosures growing out of its studies which have indicated that intercrystalline cracking of boiler metal may be influenced by many more substances than sodium hydroxide, the committee is at present engaged in an effort to clarify the whole picture relating to caustic embrittlement. Whereas the work of Professor Straub and his associates at the University of Illinois has served to point out corrective measures applicable in the majority of cases where this form of metal cracking was encountered, the industry has felt that a clearer understanding of this phenomenon could enable inhibitive treatment to be prescribed for the use of all operators of steam boilers.

The disclosure relating to the effect of silica in promoting embrittlement is now well known in the industry through publications by the research workers of this subcommittee and by Professor Straub. As a direct outgrowth of that discovery the scope of the project has been extended. The following résumé of the course of the technical work of the committee has been submitted through the chairman by Dr. W. C. Schroeder, in direct charge of the experimental work:

"The experimental study of the effect of solutions on the cracking of boiler steel has divided into two distinct phases. First, investigation of the chemical and physical factors that produce cracking; and, second, development and investigation of compounds that may prevent cracking.

"*Investigation of the production of cracking*—The discovery during 1935 that small amounts of silica played an important part in the cracking of steel at 480 F in sodium hydroxide solutions opened the road to a conception of the real factors involved in this type of failure. It also led to the tacit assumption that complete exploration of the action of these solutions would serve to correlate practically all the known facts about intercrystalline failure.

"As the exploration of the action of these solutions proceeded many facts were readily understood and brought into line but two definite discrepancies still existed and intensive investigation of these differences has now shown that a wide variety of solutions at temperatures from the boiling point to above 500 F can produce intercrystalline cracking. Some of these solutions are so effective that visible cracks may be started within one hour, and these cracks will go through a 5/16 in. boring joint section of boiler flange steel in 10 or 12 hours. Moreover, contrary to the belief up to the present time that only very concentrated solutions will cause cracking, it has been found that certain dilute solutions produce intercrystalline failure. Further investigation of the action of the dilute solutions may indicate the necessity of considerable revision in the methods now used to secure protection.

"Through a study of the influence of various embrittling solutions on the surface of the steel, it has been possible to offer a theory that serves to correlate most of the information available about this type of failure. The theory has also made it possible to predict certain solutions that will produce failure and it should prove of further value in the study of protective agents.

"*Investigation of the Prevention of Cracking*—Most of the study of the prevention of cracking has been confined to the action of sodium hydroxide-sodium silicate solutions at 80 F, since the effect of other solution combinations has been known for only a short time.

"Laboratory results indicate that sodium sulfate prevents failure only under certain limited conditions, and other inorganic salts ordinarily present in the boiler water are of little value, in so far as their action in solution is concerned. Some organic compounds have been found quite effective in preventing failure and their action is receiving further study.

"Additional study of prevention must be made at lower temperatures and with solutions other than sodium hydroxide-sodium silicate. In this investigation the possible influence of the dilute solution must also be determined."

The chairman of subcommittee VI reports further concerning the conduct of the subcommittee's activities:

Receipts, Nov. 1, 1936, to April 30, 1937 (Includes balance on hand Nov. 1, 1936)	$11,862.13
Disbursements Nov. 1, 1936, to April 30, 1937	7,092.40
Balance on hand April 30, 1937	4,769.73
Total available funds for the continuation of this project (Including balance on hand)	14,669.91

"*Committee Meetings*—A meeting of the subcommittee was held on December 2, 1936, in New York City. No meetings have since been held, but a meeting is scheduled during the Fortieth A.S.T.M. Annual Meeting in New York City, June 28-July 2. Brief monthly progress reports are made to the committee members and the chairman makes frequent trips to the laboratory. During the past six months Messrs. C. H. Fellows, L. W. Wallace, and R. C. Bardwell, committee members, have also visited the laboratory.

"*Improved Laboratory Facilities*—Within the last few weeks the Non-Metallic Minerals Experiment Station of the U. S. Bureau of Mines has been moved from New Brunswick, New Jersey, to College Park, Maryland, where it occupies ample space and has much improved facilities in a new government building. Undoubtedly the work can be prosecuted much more advantageously under this improved arrangement.

"*Laboratory Staff*—The laboratory work continues under the energetic and competent direction of Dr. W. C. Schroeder, assisted by Mr. A. A. Berk of the Bureau staff and Mr. Robert O'Brien, who is retained by the committee. These men deserve the credit for the encouraging and valuable findings which have so far been made.

"*Publications*—No reports of the work have been published during the past six months. A report is now being prepared,

[1] Presented at the Fortieth A.S.T.M. Annual Meeting, New York City, June 28-July 2, 1937.

however, which with the approval of the subcommittee will probably be published in one of the metallurgical magazines in the near future. (Progress Report No. 11.)

"Personnel—The personnel of the subcommittee has not been changed during the past six months. It consists of the following:

J. H. Walker, *Chairman*

Alex D. Bailey	S. T. Powell
R. C. Bardwell	T. E. Pursell
R. E. Hall	J. B. Romer
D. B. Keyes	R. C. Strattan
E. B. Powell	L. W. Wallace"

The work of Subcommittee VIII, Prof. A. H. White, Chairman, has been temporarily stopped pending the adoption of a program and the procurement of funds to enable that program to be carried out. The work of that subcommittee concerns the examination of existing methods, and the development of new methods, where necessary, for the determination of ions of significance in boiler feedwater and boiler water treatment. At the present time Chairman White is preparing a final report on the study of a method for the determination of dissolved oxygen.

A new project that has been under way during the past six months is that concerning coagulation and sedimentation, as these processes may be applied in the treatment of feedwater. This work is under the direction of Prof. A. P. Black, University of Florida, Chairman of Subcommittee I. The immediate work which will be undertaken by this subcommittee is the application of these processes to the problem of the removal of silica from feedwater. It is anticipated that a progress report of this work will be available to the sponsor societies by June, 1938.

The significance of the presence of silica in the water used in the modern high pressure boiler is becoming recognized. The thin hard scale produced by silica becomes more prominent in high pressure operation and the damaging effects are more serious. Deposits of silica on turbine blading are a serious factor and efforts are continually being made to eliminate this troublesome element from the boiler water cycle.

The fourth project of primary interest to the Joint Research Committee and to the industry concerned with the generation of steam is that of corrosion. The committee has taken no active steps in inaugurating a study of this subject as yet. It is, however, maintaining an interest in the research project at Purdue University in which the steam-metal reactions at high temperatures and pressures are being studied. This is a subject of major importance to the operators of steam power plants when the temperatures and pressures are continuing to rise. The present maximums are 925 F and 1400 lb. per sq. in. gage with contemplated constructions considering pressures above 2000 lb. per sq. in. This research project involves about 20 alloy steels and the test conditions cover the temperature range from 800 F to 1200 F while the pressure range extends from 400 to 2300 lb. per sq. in. gage. The reaction encountered is that which produces iron oxide at the expense of the oxygen atom in the water molecule. It is apparently a reaction that does not lend itself to the chemical control of the water, since it is brought about by the direct reaction of water or steam on very hot metal.

Although important progress has been made in the past decade in the problems of boiler water chemistry, new conditions of operation continue to emphasize the necessity for constant research in this field. Fundamentally boiler water treatment is the same for high pressure and high temperature operation as for the operation at lower pressures and temperatures. Exactness of control of the chemical reactions involved is the basis for successful treatment of the treatment of water for modern boilers.

Respectfully submitted on behalf of the Joint Research Committee,

C. H. FELLOWS,
Chairman.

R. C. BIRDWELL,
Vice-Chairman.
J. B. ROMER,
Secretary.

Paper Available on Pitting Resistance of Metals

AT THE recent meeting of the Hydraulic Division of The American Society of Mechanical Engineers, held at Ithaca, a paper was presented by J. M. Mousson, Safe Harbor Water Power Corp., Lexington Building, Baltimore, Md., on the subject "Pitting Resistance of Metals Under Cavitation Conditions." This paper describes the apparatus and procedures used in determining the pitting resistance of metallic materials under accelerated cavitation conditions. The results are compiled in a series of tables and the classification of metals is discussed. Through the courtesy of the Safe Harbor Water Power Corp., members of the A.S.T.M. who would be interested in having a copy of this paper can obtain one without charge by writing direct to the company in Baltimore.

J. H. Gregory Reference Library Dedicated

THERE was recently dedicated in City Hall, Columbus, Ohio, The John H. Gregory Sanitary and Municipal Engineering Reference Library comprising the professional library of the late John H. Gregory, Consulting Engineer, presented to the City of Columbus, Ohio, at his request, as an expression of appreciation of the confidence placed in him during his twenty-two years of service with the City. Various city officials, including the city attorney, the city council and the mayor participated in the ceremonies which were presided over by C. B. Hoover, Chairman of the Library Committee. This library has recently become a member of the Society. Mr. Gregory was formerly Professor of Civil and Sanitary Engineering, The Johns Hopkins University, and Consulting Engineer. He was awarded prizes by the American Society of Civil Engineers for certain papers which he wrote dealing with problems relating to his work for the city of Columbus. He was a member of the Society from 1906 until his death early this year.

R. A. Bull Dies

JUST as this portion of the BULLETIN goes to press, word has been received of the sudden death on July 29, of R. A. Bull, Consultant on Steel Castings, Chicago, Ill. Mr. Bull passed away in Anniston, Ala., where he had been on one of his regular consulting trips. He was quite ill the night before and died in his sleep early in the morning from heart trouble. He had been very active in the work of the Society. Further details of his activities will appear in a subsequent BULLETIN.

Numerous Standardization Activities Under Way

Committees Have Active Programs

A NUMBER of important standardization activities including several nearing completion and others on which work has been started or will be in the very near future are summarized in the material which follows. This information supplements in many cases reviews of committee work which are detailed in the respective annual reports. The information given will convey some conception of the progress being made in the development of standard specifications and tests as affecting important engineering materials.

METALS AND METAL PRODUCTS

The Steel Committee plans to revise the Standard Specifications for Seamless Alloy Steel Pipe for Service at Temperatures from 750 to 1100 F., this to be reverted to the status of tentative and will cover in a separate new specification the carbon-molybdenum alloy P1 because of its extensive use. A number of changes are being considered in the Tentative Specifications for Alloy-Steel Bolting Materials for High Pressure and Temperatures to 1100 F. (A 193 - 36 T). These three items are expected to be submitted to Committee E-10 during the summer.

Committee A-2 on Wrought Iron is completing specifications for rolled shapes and bars covering shapes from small to large sizes. The Committee on Malleable Iron Castings has under consideration the preparation of specifications for pearlitic malleable iron.

The Committee on Iron-Chromium Nickel and Related Alloys is working on specifications for wrought products and a subcommittee is being organized on specifications for tubular products.

Specifications for chain-link fence galvanized before weaving, methods for determining thickness of plated coatings and methods for determining weight of coating on galvanized hardware are being developed by Committee A-5 on Corrosion of Iron and Steel. The utility of the Preece test for determining uniformity of coating on hardware is being studied looking toward the development of a standardized procedure during the coming year. Revisions of certain specifications already issued by the committee are being developed.

The Committee on Corrosion of Non-Ferrous Metals and Alloys has under consideration the development of a recommended method for salt-spray testing. A method of test for temperature coefficient of manganin is in course of preparation by Committee B-4 on Electrical-Heating, Electrical-Resistance and Electric-Furnace Alloys. Newly organized work on the development of test methods for metallic materials used in radio tubes and metals and incandescent lamps is under way, with five sections dealing with strip, wire, tubing, coated material, and powdered materials and liquids. A suitable method of test to determine the durability of resistor alloys exposed to controlled atmospheres at high temperatures in electric furnaces is under consideration.

The Committee on Light Metals and Alloys is developing standards for aluminum-base alloys in ingot form for die castings, this work to be done in cooperation with Committee B-6 on Die-Cast Metals and Alloys. A study of methods of testing anodized coatings on aluminum and aluminum alloys is under way. The committee's annual report included an appendix dealing with this subject.

Committee B-5 on Copper and Copper Alloys, Cast and Wrought, has a number of standardization projects before it including the promulgation of specification requirements for copper-bearing alloy wires, lead-bearing brasses in the form of sheet and strip, nickel silver sheet, strip and extruded shapes and casting alloys of this material, and commercial tubes of various alloys other than condenser tubes and plumbing pipes.

BUILDING UNITS; CEMENTITIOUS MATERIALS, ETC.

The newly organized Committee C-15 on Manufactured Masonry Units, formed by the merging of Committees C-3 on Brick and C-10 on Hollow Masonry Building Units, will consider requirements relating to the weathering properties of sand-lime and concrete brick, since the current specifications contain no requirements on these properties. The glazed building unit specifications issued last year have been widely discussed and the committee will consider the need of revisions, particularly in connection with dimensional requirements on which a number of constructive comments have been received. The committee expects to make progress in the development of definition of terms relating to masonry units, since conflicting views may be better harmonized with the new committee set-up.

Committee C-1 on Cement will give further study to the proposed specifications for blended cement which were printed in the report, but referred back to the committee. Work on specification requirements for cement containing predominating amounts of slag for the setting of masonry will be continued. The working committee on fineness will carry on its active work in connection with the fineness requirements in the various standards for hydraulic cements.

The Committee on Concrete and Concrete Aggregates has on its program the development of a method of test to determine the value of a curing agent for concrete, a study of methods of determining the structural strength of fine aggregates, test for unit weight of large sized coarse aggregates (2 to 5 in.), and a method for making concrete test specimens from vibrated concrete.

A standard method for determining thermal conductivity of refractory materials at high temperatures is being considered by Committee C-8 with the cooperation of the National Bureau of Standards and a proposed method of measuring warpage of special refractory shapes is under discussion. The Lime Committee will continue its study of the method of test for the soundness of lime and will consider suggestions received on the proposed specifications for hydraulic lime. The definitions of lime and lime products are being studied intensively. A series of suggested tentative specifications covering lime for the paper and pulp industry are expected to result from studies in this field. Work on a test for fineness of pulverized quicklime is also current. Committee C-11 on Gypsum has completed research work on the ammonium acetate method of determining sand content of set plaster and is planning to prepare a paper on this matter.

PAINTS, PETROLEUM, COAL

Committee D-1 on Paint, Varnish, Lacquer, and Related Products has completed four new proposed standards which it expects to refer to the Society for action during the summer. These involve a test for reactivity of paint liquids, specifications for c.p. zinc yellow (zinc chromate), for para red tona, and for reduced para red. Certain revisions in existing specifications will also be recommended, it is anticipated.

At its meeting in New York, Committee D-5 on Coal and Coke considered matters relating to the methods for determining fusibility of coal ash. It was indicated that satisfactory progress is being made on proposed methods for determining coal friability. The committee is organizing a new subcommittee on ignitability. Another on the significance of tests of coal will prepare two pamphlets: the first being complete with respect to technical details and the second of a nature that will give the small consumer advice on the selection of coals without going to the expense of sampling and analysis.

TIMBER, ELECTRICAL INSULATING MATERIALS, RUBBER, SOAPS

The Committee on Timber will continue its work with methods for determining moisture in lumber, will consider certain unfinished items on which work has been done and will study the adoption of methods for determining component parts of mixtures of zinc chloride and sodium bichromate.

Committee D-9 on Electrical Insulating Materials is continuing work on definitions for various types of varnishes and also the work on cure tests and arc-resistance tests of molded insulating materials. Methods of tests for identity of phenolic materials and methods for the measurement of the thickness of large sheets are being developed by the committee at the request of certain interests. Specifications for laminated phenolic materials for radio use have been drafted and are being studied. The committee has under way a complete revision of the method of test for dielectric strength which will include all of the test procedures now described in the standard methods in the jurisdiction of the committee. Other projects are active.

Committee D-11 on Rubber Products plans to combine into a general set of test procedures the two existing A.S.T.M. standards on testing rubber hose and include additional tests required for types of hose not covered. Revisions of the standard specifications for rubber gloves have been developed, major changes suggested including the introduction of an accelerated aging test and increase in tensile strength, elongation and weight requirements. Proposed specifications for tough rubber sheath compounds have been drafted and are being studied. Nearing completion is a standard method of test for properties of rubber and rubber-like materials in liquids which will include details on size of test specimens, equipment, methods of measurement and conditions of test.

The Committee on Soaps and Detergents expects to continue its active program which will involve standards for built soap (powdered) and for trisodium phosphate; also for rosin laundry soaps, ordinary soaps, etc. Active work is under way also on dry cleaning soaps and sulfonated detergents—in these two fields a number of difficulties must be overcome.

A list of the numerous projects which Committee D-13 has in its program appeared in the April BULLETIN and was also covered in the annual report of the committee. Activities involve the development of specifications and tests for a large number of materials in the province of the committee and also various research projects to develop necessary information.

Merged Committee on Masonry Units

As a result of suggestions which had been made on the possibilities of merging Committees C-3 on Brick and C-10 on Hollow Masonry Building Units, a joint meeting of the committees was held during the A.S.T.M. annual meeting which resulted in the consolidation of the two committees into a new group with a title "Committee C-15 on Manufactured Masonry Units." Decision to consolidate was made because of the similarity in certain phases of the committees' work and the fact that under one committee specifications for certain materials could be handled without overlapping jurisdiction.

The scope of the new committee was approved as follows:

Specifications, methods of testing and definitions relating to units of inorganic substances such as building brick of clay, sand-lime and concrete; structural clay tile; paving brick; hollow concrete units; sewer brick and block; and glazed building units. The units shall not include natural building stone or slate nor products intended for use as refractories.

All of the members of Committees C-3 and C-10 are to be invited to apply for membership on the new committee. At the meeting the following officers were elected:

Chairman: D. E. Parsons, Chief, Masonry Construction Section, National Bureau of Standards.

First Vice-Chairman: T. I. Coe, Technical Secretary, American Institute of Architects, Structural Service Dept.

Second Vice-Chairman: W. G. Kaiser, Manager, Cement Products Bureau, Portland Cement Assn.

Secretary: J. W. Whittemore, Professor of Ceramic Engineering, Engineering Experiment Station, Virginia Polytechnic Institute.

Several subcommittees are to be organized and in addition to an advisory subcommittee, groups will function in the following fields: Clay building brick, concrete units, sand-lime brick, paving brick, sewer brick, glazed brick and tile, and structural clay tile.

Answers to Problems

THE answer to the division problem given in the April BULLETIN in which there was a dividend of eight unknown figures, a divisor of three unknown figures, and the middle figure of the quotient of five figures given as "8," is as follows: divisor, 124; quotient, 80809; and dividend, 10,020,316.

The answer on the cigarette problem, five men having various numbers and brands of cigarettes, is as follows:

Brown—Old Golds—3
Perkins—Chesterfields—15
Turner—Raleighs—6
Jones—Luckies—20
Reilly—Camels—8

Additional problems will appear in the BULLETIN from time to time. Problems of a nature that would be pertinent for the BULLETIN would be welcomed from any of the members. These should be sent to the Society Headquarters *and* because the Problem Editor may get "stuck" on the problem, the solution should accompany it.

Numerous Publications to Be Issued

List Includes Several Special Items

In addition to the so-called regular publications including the *Proceedings,* 1937 Supplement to the Book of A.S.T.M. Standards, Year Book, Index to Standards, etc., there are a number of special books which are to be published within the next few months, these having been authorized by the Committee on Papers and Publications for publication during the year.

Brief notes on some of these publications are given below for the information of the members and a list of all of the publications with the special prices to members and other descriptive information will be sent in the form of an order blank to each member in September.

The special compilations of standards issued during the past few years have become of increasing significance and, as indicated below, new editions of these widely used books are to be published.

REGULAR PUBLICATIONS

1937 Proceedings.—Will include, as usual, the technical papers, committee reports, new and revised tentative standards and tentative revisions of standards presented at the 1937 annual meeting. The inclusion of the extensive discussion of the various items adds to the value of the data given. The *Proceedings* will be sent to each member late in the year.

1937 Supplement to Book of A.S.T.M. Standards.—In view of the large number of actions taken at the annual meeting on the adoption of standards and revisions of existing standards, the 1937 Supplement to the Book of A.S.T.M. Standards will be one of the largest yet issued. Work is now under way on this publication and it is expected that copies will be ready for distribution to the members in September.

1937 Book of Tentative Standards.—A compilation of *all* of the tentative standards of the Society, over 300, in their latest form. Although the current *Proceedings* will give the new tentative standards and revisions approved this year, the convenience of having in one place *all* of the A.S.T.M. tentative specifications and methods makes this book in wide demand. Ready about November 1.

Index to Standards and Tentative Standards.—This Index, which becomes of greater value as the number of specifications increases, will again give the latest complete references to publications where the various specifications and test methods appear. This is furnished to members and is also widely distributed on request. Members can obtain additional copies without charge.

Year Book.—Includes a list of the complete membership of the Society (name, address, company, etc.), the personnel of all A.S.T.M. committees, and other pertinent information. Furnished to members on request.

Symposium on Lubricants.—The special volume containing the papers and discussion presented in connection with the Symposium on Lubricants at the Chicago Regional Meeting of the Society in March is now ready for press, and copies should be available within the next few weeks. Members wishing to secure copies should fill in the special members' order blank which accompanies the Summary of Proceedings being mailed to the members under separate cover.

SPECIAL PUBLICATIONS

Symposium on Wear of Metals.—It is planned to issue the six papers comprising the Symposium on Wear of Metals, held in conjunction with the meeting sponsored by the Philadelphia District Committee, as a special publication. The symposium should be available within the next few months.

1937 Marburg Lecture.—The Marburg Lecture on "Plastics: Some Applications and Methods of Testing," delivered by Dr. T. Smith Taylor, will be included in the 1937 *Proceedings* and prior to the publication of these *Proceedings,* reprints of the symposium will be issued.

Symposium on Correlation Between Accelerated Laboratory Tests and Service Tests on Protective and Decorative Coatings.—Consideration is being given to making the discussion on Correlation Between Accelerated Laboratory Tests and Service Tests on Protective and Decorative Coatings available as a special publication.

Symposium on Consistency: Critical Discussion on Present-Day Practices in Consistency Measurement.—At the recent annual meeting a number of papers were presented in connection with the Symposium on Consistency: Critical Discussion on Present-Day Practices in Consistency Measurement. Consideration is now being given to the publication of these papers together with the discussion.

Special Compilations of Standards.—A number of the standing committees, under whose auspices have been issued special compilations of standards covering specific industrial fields, have recommended that new editions of these compilations be made available during the year. All of the A.S.T.M. standard and tentative specifications and tests in the following fields will be included in the respective volumes: Refractories, petroleum products, electrical insulating materials, textile materials, and rubber products.

Rules for Mental Health

There recently appeared in the *Cenco News Chats* a set of rules for mental health originally published by the Cleveland Academy of Medicine. These received the first prize in a contest among members of the Academy for formulating such rules. These rules may be of interest to a number of BULLETIN readers and they are presented from this viewpoint.

1. Have a Hobby: acquire pursuits which absorb your interest. Sports and "nature" are best.
2. Develop a Philosophy: adapt yourself to social and spiritual surroundings.
3. Share Your Thoughts: cultivate companionship in thought and in feeling. Confide, confess, consult.
4. Face Your Fears: analyze them; daylight dismisses ghosts.
5. Balance Fantasy with Fact: dream, but also do; wish, but build; imagine, but ever face reality.
6. Beware Alluring Escapes: alcohol, opiates and barbitals may prove faithless friends.
7. Exercise: walk, swim, golf; muscles need activity.
8. Love, but Love Wisely: sex is a flame which, uncontrolled, may scorch; properly guided, it will light the torch of eternity.
9. Don't Become Engulfed in a Whirlpool of Worries: call early for help. The doctor is ready for your rescue.
10. Trust in Time: be patient and hopeful; time is a great therapist.

Record-Breaking Annual Meeting

(Continued from page 7)

be controlled within ± 2 deg. Fahr. The authors indicate that maximum stress in the specimen can be calculated within an accuracy of ± 3 per cent.

The other paper on "Fatigue Properties of Metals Used in Aircraft Construction at 3450 and 10,600 Cycles," described a ball bearing rotating-beam machine operating at 10,600 cycles and the results of comparative tests on these machines and ball-bearing and plain-bearing machines operating at 3450 and 1725 r.p.m. Plain and notched specimens were used and operating temperature discussed. The values for the fatigue limits were not appreciably affected by this range of speed.

CORROSION

In the session on corrosion, reports of Committees B-3 on Corrosion of Non-Ferrous Metals and Alloys and A-5 on Corrosion of Iron and Steel were presented. The latter included the report of the wire test committee and an extensive appendix listed the exact numbers and types of specimens which have been exposed in this country-wide program, distribution to the various test sites and the locations in the test plot. Photographs of the wire test sites were included.

The paper on "Corrosion Testing Methods for Copper Alloys" classified corrosion phenomena according to causes and results and indicated that the alternate-immersion and water-line tests described incorporate many of the causes and forms of corrosion with their several variations. The authors consider tensile strength measurement the best means of evaluating corrosion losses since this is subject to fewer errors and is related more closely to the amount of damage done.

There was continuation of the discussion of the Symposium on Corrosion Testing Procedure which was a feature of the Chicago Regional Meeting, this following a digest of the symposium prepared by L. W. Hopkins, American Chain Co., which summarized the principal points in the papers. Many at the session participated in the discussion.

SYMPOSIUM ON CONSISTENCY

One of the very interesting sessions of the Fortieth Annual Meeting was the one devoted to a Symposium on Consistency: Critical Discussion of Present-Day Practices in Consistency Measurement. This symposium was arranged under the auspices of Committee E-1 on Methods of Testing and included nine technical papers by authorities in different industrial fields.

E. C. Bingham of Lafayette College, chairman of the A.S.T.M. Technical Committee on Consistency, Plasticity, etc., outlined recent progress in consistency measurement pointing to the realization of the need for a practical standard of viscosity. He outlined errors in viscosity due to lack of attention to correction factors. He mentioned that the resolutions of the World Petroleum Congress in London marked an important step in our progress, but that these placed the responsibility upon each nation for obtaining results which are readily usable or convertible for use of all. These resolutions in part indicated that viscosity should be expressed in C.G.S. units and should be expressed as kinematic viscosities, but that specific gravities should be reported in addition.

The paper on "Definition of Consistency and Theoretical Considerations" gave analyses of A.S.T.M. consistency and plasticity tests. There were several papers discussing consistency measurements in various industries such as paint, asphalt, coal-tar industry, rubber and rubber products, and petroleum and petroleum products.

In discussing "Viscosity Measurement of Petroleum Products and Lubricants" the author pointed out that one of the most important problems rheologists have is the adoption of an international scale of viscosity units since it would eliminate considerable expensive laboratory testing and simplify the preparation of specifications.

Discussion of the problem from the standpoint of the rubber field emphasized that the need for an absolute plastometer for research purposes only and with negligible value in control justifies extended research and further expenditure of money by industry. The problem of adapting the instrument for control requirements could then be taken up.

CEMENT AND CONCRETE

While Committee C-1 on Cement had included in its report proposed specifications and methods of test for blended cements, action was taken at the annual meeting to refer these back to the committee for further consideration because of a divided vote. A revision for immediate adoption in the Specifications for Portland Cement (C 9 - 30) is being referred to Society letter ballot. This provides for the elimination of the fineness test of cement on the No. 200 sieve. Data developed by a special working committee show that sieve residues bear little or no relation to the fineness as indicated by specific surface. In the working committee's report it was indicated that "the general opinion is that the present fineness requirement in the cement specifications has been meaningless for many years. This requirement should either be eliminated, or if a fineness test is deemed necessary by a majority, it should be replaced by some method that furnishes dependable information on particle size distribution, specific surface, or minimum percentage of some fine fraction designated by maximum particle size."

It is pointed out in the Report of Committee C-1 that in the present transitional stage the Society's standards for hydraulic cements exhibit quite a difference in fineness requirements, and this fact illustrates the need for the active work which the Working Committee on Fineness has under way.

The paper "Tricalcium Aluminate and the Microstructure of Portland Cement Clinker," pointed out that recognition of C_3A in portland cement clinker by microscopic examination has been found exceedingly difficult. To determine its mode of occurrence, that is, its relation to the structure of clinker, about 150 experimental burns were made ranging from pure C_3A through high-alumina silicate mixes into the field of portland cement compositions. The charges were examined in thin sections, especially prepared to yield optimum clarity.

It is found that C_3A crystallizes in large units, enclosing C_3S, and C_aO when present, but with a tendency to exclude C_4AF. In this habit C_3A becomes a matrix or interstitial material which, because of its close similarity in optical properties to those of C_3S, its presence usually in minor amounts, and general lack of crystal outlines in silicate

mixes, is quite difficult to distinguish. Its presence is demonstrated indirectly through its control over the orientation of C_4AF crystallites, which show a common mass or field birefringence over large, roughly equidimensional areas. The common lack of such criteria in commercial clinker indicates that crystalline C_3A is not present in the amounts generally calculated.

Committee C-9 on Concrete and Concrete Aggregates submitted two proposed tentative standards, which were approved, covering tentative specifications for lightweight aggregate for concrete and proposed method of test for abrasion of coarse aggregate by use of the Los Angeles machine. In the former requirements are given covering grading, unit weight, mortar strength and soundness. The specifications indicate that "Lightweight aggregates shall consist of pumice, lava, tufa, slag, burned clay, cinders derived from the high-temperature combustion of coal or coke showing a loss on ignition of not more than 25 per cent (40 per cent) and volatile matter of not more than 5 per cent, or, subject to approval by the engineer, other material having strong, durable particles and conforming to the requirements of these specifications."

The new abrasion method using the Los Angeles machine is intended for determining the abrasive resistance of crushed rock, crushed slag, uncrushed gravel and crushed gravel. This tentative method was prepared in cooperation with Committee D-4 on Road and Paving Materials to meet the need for a more accelerated abrasion test and one which would introduce the effect of impact more definitely.

One of the outstanding papers at the annual meeting was the one on "Plastic Flow and Volume Changes of Concrete" giving the results of important research work at the University of California carried on over many years having to do with volume changes of concrete and pointing out the significance as applied to design and construction problems. The paper is devoted chiefly to volume changes under the action of sustained loads, which is termed plastic flow. It is now generally believed that shrinkage and plastic flow are closely related phenomena, each being primarily due to changes in the amount of adsorbed water in the cement gel and being but little directly influenced by the free water occupying the pore spaces within the concrete mass. On the whole, plastic flow does not seem to be an undesirable property.

Started in 1926, plastic flow investigations at the Engineering Materials Laboratory, University of California, have comprised to date some 25 series of tests. Recent series of tests, undertaken during the period 1934 to 1937, have included studies to determine (1) effect of water-cement ratio and aggregate-cement ratio upon plastic flow, (2) effect of fineness and composition of cement upon plastic flow, (3) plastic flow of concretes in tension and in compression, (4) fiber strains in plain concrete beams under constant sustained bending moment, and (5) stresses developed in large concrete cylinders under complete axial restraint during a heating-cooling cycle similar to that which will occur in mass concrete.

Observations of plain concrete cylinders which have been under stress for a period of 10 years indicate that the plastic flow is still increasing at a measurable rate. In a series of tests on reinforced concrete columns which have now been under load for a period of 5½ years, the stress in the steel is still increasing and the stress in the concrete is still decreasing at the end of this period.

The effect of water-cement ratio upon plastic flow is marked. The results up to the age of about two years show that between two concretes of equal cement content, the one having the higher water-cement ratio exhibits the largest flow. For example, the flow for a water-cement ratio of 0.7 was 50 per cent greater than for a water-cement ratio of 0.6.

It has frequently been assumed that flow of concrete in tension is approximately the same as the flow in compression. The results of two series of tests indicate that this is not true, but definitely show that for certain cements, including low-heat and normal portlands, the flow in tension is considerably greater than that in compression, at least up to the age of 6 months.

The results of observations of plastic flow of mass cured concretes made with a normal portland and a low-heat portland, each ground to the same surface area, show a marked effect of composition of cement upon plastic flow in compression. Up to 4 months, the flow of the low-heat portland is approximately double that of the normal portland.

In a further series of tests undertaken to study the effect of fineness of cement upon flow it has been observed that concrete containing coarsely ground low-heat portland cement exhibited much the largest plastic flow at all ages.

MASONRY MATERIALS AND REFRACTORIES

"The Wick Test for Efflorescence of Building Brick" was described—this test consisting of standing a whole brick on end in 0.5 in. of distilled water, maintained at approximately a constant level. The brick, except that portion in contact with water, is exposed to the air of the laboratory at ordinary temperature. At the end of 5 days the brick is dried in an oven at 105 to 110 C. for at least 18 hr. and the amount of efflorescence is estimated by visual comparison with an untreated specimen. The authors concluded that the results of the 5-day wick test correlate well with the grading on exposed panels when the efflorescence on individual bricks rated in excess of "moderate" on the scale used for grading intensity of visible efflorescence.

Committee C-8 on Refractories submitted three new tentative standards—Definitions of Terms Relating to Alumina-Diaspore Refractories, Methods of Test for Cold Crushing Strength and Modulus of Rupture of Refractory Brick and Shapes, and Methods of Chemical Analysis of Refractory Materials. The proposal to adopt as standard the Tentative Definitions of Terms (C 71 - 36 T) was not approved and these will be continued as tentative.

An up-to-date description of "The Celite Type High-Temperature Thermal Conductivity Apparatus" was presented. Four units of this apparatus are being used daily for testing thermal insulation at temperatures up to 1600 F. The author reported that a method of conducting the test makes possible results in a form approximating the mathematical concept of conductivity.

Committee C-10 on Hollow Masonry Building Units submitted new tentative specifications and tests for concrete units for non-load-bearing masonry which apply to strength, moisture content and general requirements of hollow non-load-bearing concrete masonry units made from portland cement and suitable aggregates such as sand, gravel, crushed

stone, bituminous or anthracite cinders, burned clay or shale, and blast-furnace slag.

PAINT PRODUCTS

One of the features of the meeting was the Symposium on Correlation Between Accelerated Laboratory Tests and Service Tests on Protective and Decorative Coatings which was arranged by Committee D-1 on Paint and Related Products. This Symposium consisted of discussions by leaders in the industry under three main topics—Finishes for Indoor Service; Paints for Exterior Service on Wood; and Paints for Iron and Steel. The main purpose of the Symposium was to bring out as much as possible of what is known about correlation between accelerated tests and service tests. A large number of technologists who were present gave various case histories and data which they had developed on this important subject. There was a large attendance of engineers and technologists at the fifth session in which the Symposium was held.

Committee D-1 in presenting its report submitted four new tentative standards comprising specifications for zinc-sulfide magnesium pigment and for titanium-magnesium pigment, methods of routine analysis of zinc yellow pigment (zinc chromate yellow) and method of test for spectral apparent reflectivity of paints.

At the meeting of Committee D-1 there was an innovation in the form of five short papers on the following subjects:

"Development of Hiding Power Test Methods," by D. L. Gamble.
"A Proposed Test for Determining the Reactivity of Varnishes and Paint Liquids," by Sidney Werthan.
"Determining the Depth of Color in Varnishes," by G. C. Sward.
"Accelerated Testing of House Paints," by C. H. Rose.
"Accelerated Testing of Paints for Iron and Steel," by J. C. Moore.

PETROLEUM PRODUCTS

Four test methods on the recommendation of Committee D-2 on Petroleum Products and Lubricants were accepted for publication as tentative. These methods cover kinematic viscosity, conversion of kinematic viscosity to Saybolt universal viscosity, distillation of plant spray oils, and test for vapor pressure of petroleum products (Reid method). The latter is a consolidation and revision of the former test for vapor pressure of natural gasoline (D 323) and motor and aviation gasoline (D 417).

A paper by C. E. Headington and J. C. Geniesse on "Method for Converting Kinematic Viscosity to Saybolt Universal Viscosity" was presented in support of the new tentative method on this subject.

Two proposed methods submitted for publication as information covered, respectively, a test for dropping point of lubricating greases and test for unsulfonated residue of plant spray oils. Subcommittee V on Viscosity has been very active and Committee D-2 approved its recommendations covering several new and revised viscosity-temperature charts; also a proposal to publish Kinematic-Saybolt conversion tables and take immediate action on proposed revisions of the Method of Test for Viscosity by Means of the Saybolt Viscosimeter (D 88 - 36) to take care of certain difficulties encountered with cut-back asphalts.

The viscosity-temperature charts include two for kinematic viscosity and two for Saybolt Universal viscosity, of the following ranges in viscosities and temperatures:

1. Kinematic Chart: 2 to 20 million centistokes, —30 to 450 F.
2. Kinematic Chart: 0.4 to 100 centistokes, —30 to 450 F.
3. Saybolt Chart: 33 to 100 million Saybolt Universal Seconds, —30 to 450 F.
4. Saybolt Chart: (8½ by 11 in.) 33 to 100,000 Saybolt Universal Seconds —10 to 300 F.

"A Laboratory Channel Test for Gear Oils," was outlined in this session. Since the first prerequisite of a laboratory channel test is correlation with oil performance in axles, axle channel tests at low temperatures formed the first step in the development of such a test. In the axle tests the channeling temperature was taken as that temperature at which 40 per cent of the oil was in circulation after 10 min. of axle operation.

Channeling was found to be most severe at the lower speeds and most of the work was done at an axle speed equivalent to 20 m.p.h. car speed. It was found also that the temperature reached during operation had a profound effect upon distribution after rechilling, due to an air-oil emulsion which persisted during the rechilling period. Under such conditions channel temperatures varied between 20 deg. Fahr. below and 20 deg. Fahr. above the A.S.T.M. pour point.

On the basis of these axle data a laboratory test was developed which gave reasonable correlation with the observed performance of the oils in the full-size axles. The test employs standard A.S.T.M. pour-point equipment with the addition of a special stirring apparatus which reproduces the aerating action of the rotating axle gears.

SYMPOSIUM ON SIGNIFICANCE OF COAL TESTS

Under the sponsorship of Committee D-5 on Coal and Coke a Symposium was held on Significance of Tests of Coal. The authors of the paper on "Pulverizer Performance as Affected By Grindability and Other Factors" concluded that the relative ranking of a coal depends on the method used, no two methods assigning the same relative rank to the same coal. The two A.S.T.M. tentative methods assign quite different relative ratings to the same coal, but these ratings may be correlated in view of the permissible accuracy with which tests may be checked and reproduced by these methods.

A. W. Gauger, Pennsylvania State College, who was in charge of preparation of the Symposium presented a paper on "The Significance of Ash-Softening Temperature and Ash Composition in the Utilization of Coal." In his opinion the importance of ash fusibility as measured by the standard A.S.T.M. ash softening temperature test has been over emphasized. Had there been no coal with highly refractory ash, the problems incident to ash disposal (including clinkering, etc.) would have been solved by equipment design and firing practice. Since the reserves of coal with highly refractory ash are not large, these problems will ultimately have to be solved in that manner.

In the meantime it is evident that the present ash softening temperature method is only a qualitative index of the probable severity of clinker formation; consequently, a search will continue for methods which offer promise of being better

indices. Several such interesting developments are under way.

In a paper on "Laboratory Tests Relating to Caking, Plastic, Gas- and Coke-Making Properties of Bituminous Coals," the author pointed out that although there were no standard methods of determining the relative caking, plastic, gas- and coke-making properties of bituminous coal with particular reference to the manufacture of coke, this did not indicate the lack of interest in or of value of the information. He outlined various tests on these properties.

Conclusions of the paper on "Significance of Friability and Size Stability Tests on Coal," pointed out that the general serviceability of the drop shatter and tumbler test methods may be stated to be a means of placing coals in groups in respect to size stability per cent and friability per cent; a range of ten has been suggested for individual groups. The testing of coals by the two methods is advisable in order to indicate the relative handling properties in respect to friability. The drop shatter test serves for determining the resistance to breakage due to a lesser amount of handling as in the ordinary preparation and transportation of lump coal, while the tumbler test serves for determining the liability to further breakage and ease of breakage when the coal is subjected to rougher handling as in mechanical conveyors, feed devices, crushers, etc.

ASPHALT AND ROAD MATERIALS

Chemical evidence supporting the conclusion drawn from the rheological properties of cracked asphalts, that their greater degree of dispersion as compared with straight-run asphalt can be accounted for by the greater aromaticity of the maltenes was given in a paper on "The Constitution of Cracked and Uncracked Asphalts." It was further shown that the components in low-level cracked asphalt have in all probability average molecular weights lower than that of the corresponding components in a straight-run residue. The chemical structure of asphaltenes was discussed, together with the probability that they consist of a combination of units consisting of cyclic groups of probably no more than two or three rings condensed together.

Another paper pointed out that the increase in consistency of asphalts with time indicates the development of internal structure. This structure is developed more rapidly in air-blown than in steam- or vacuum-refined bitumens; it is partially or wholly eliminated by heating or mechanical working. In asphalt-mineral mixtures age-hardening appears to be chiefly dependent on the nature of the bitumen present. It has been indicated that the higher the rate at which internal structure develops, the more marked the deviation from viscous flow.

Asphalts with high rates of age-hardening and definite deviations from viscous flow give characteristic microscopic patterns when the surfaces are etched with ethyl ether or 86° Baumé naphtha. Essentially viscous asphalts have low rates of age hardening and show no surface patterns. The explanation offered for the increase of consistency with time is that a gradual isothermal sol-gel transformation takes place, the magnitude of which depends on the source and method of processing.

Committee D-8 on Bituminous Waterproofing and Roofing Materials offered a number of recommendations resulting from intensive work during the year. Two methods of test for sieve analysis of granular and non-granular mineral surfacing for asphalt roofing and shingles were approved as new tentative standards. The committee studied in detail specifications for asphalt for use in damp-proofing and waterproofing above and below ground level and recommended a new consolidated tentative specification replacing the two former ones. The new specification for coal-tar pitch for roofing, damp-proofing and waterproofing conforms to present practice in eliminating differential requirements for type and use and replaces six former tentative specifications.

"The Design of Asphalt Mixtures for Underwater Construction," was covered in a paper which described progress made in developing asphalt mixtures for mass construction above and below the water line with special reference to jetty work in the United States.

In discussing "The Constituents of Asphaltic Materials *versus* Accelerated Weathering," the author described the separation into asphaltenes, resins and oils of 200 F. melting point asphalts prepared from Mexican, Gulf Coast, and Mid Continent crude. Synthetic asphalts were prepared by recombining these constituents in various proportions and from different sources. Accelerated weathering data were obtained on these materials. Results indicated an increased resistance to weathering when increased proportions of resins were used. The author indicated that good weathering is dependent not only upon the character and source of the resins and oils but also upon the quality of the asphaltenes. These constituents from different asphalts vary widely in their characteristics, it was stated.

The paper on "Indentation and Compression Shear Tests for Determining Service Stability of Asphalt Plank" reported on the adaptation of the McBurney indentation test, a test originally designed for asphalt tile, to the testing of asphalt plank.

TIMBER AND NAVAL STORES

New tentative Specifications for Fire-Retardant Properties of Wood for Scaffolding and Shoring were prepared by Committee C-5 on Fire Tests of Materials and Construction. The report indicated that "the need for standard specifications by which to judge the suitability of a material for scaffolding from the standpoint of fire resistance seems evident from a number of serious fires, originating on or in connection with scaffolding. . . . The materials used in the construction of scaffolding and shoring are wood and steel. . . . It is wood that is the material that needs protection. In the case of a serious conflagration neither of the two materials is immune to destruction. No new method of testing is prescribed in the proposed specifications. The timber test described therein is one that has been in use for 33 years (devised by the late Ira H. Woolson, former chairman of Committee C-5) for official testing purposes by the building authorities of New York City in passing on the acceptability of chemically treated wood under the city building code. In effect, the proposed specifications are merely a needed yardstick for measuring the fire resistance of wood used in the construction of temporary equipment where it is deemed unnecessary to secure as great a fire resistance as required in permanent construction."

Results of tests made on balsa wood ranging in density from 5.18 to 14.86 lb. per cu. ft. were given in the paper on

"The Mechanical Properties of Balsa Wood." Properties investigated were the elastic limit, modulus of rupture and modulus of elasticity in bending; the elastic limit, ultimate strength and modulus of elasticity in compression parallel and perpendicular to the grain; column strength and cleavage. Studies were also reported on the strength of balsa under sustained or long-time bending loads. The investigation shows that: (1) all of the mechanical properties of balsa which were studied vary with the density according to equations which have been developed, and (2) after allowance for the difference in density, the strength of balsa compares favorably, particularly for the higher densities, with the strength of such woods as white pine and redwood.

Committee D-17 on Naval Stores submitted two proposed standards which will be issued as tentative covering methods of test for acid number of rosin and test for saponification number of rosin. These new methods are based on work which the committee has had under way during the past year involving a series of interlaboratory tests.

WATER

The paper on "Technique in the Determination of Dissolved Oxygen" pointed out the need for determining extremely small concentratons of dissolved oxygen in plant waters, particularly those pertaining to boiler plants. The various modifications of the basic Winkler procedure appearing in the literature were considered from the standpoints of sensitivity, accuracy and practicability in the plant. The Schwartz and Gurney double titration B modification, with several recommended changes in procedure is believed to be the simplest to operate with a sensitivity and accuracy equal to other methods and hence most satisfactory. The author made recommendations for comparative tests of all methods, for further investigation of the electrometric titration and for determining the permissible limit in the sample of contaminants such as nitrite and sulfite.

Corrosion in stressed mild steel at elevated temperatures by solutions of sodium hydroxide and silica is not wholly electrochemical, but colloidal phenomena are involved it was reported in another paper. The author showed by thermodynamic calculations that the spontaneity of the corroding reactions of iron in water is not affected by the hydroxyl ion concentration and that the observed increase in the rate of corrosion with sodium hydroxide concentration is probably due to peptization.

It is believed that silica precipitates the peptized iron oxide to protect the ferrite grains while permitting corrosion along highly stressed and probably cracked grain boundaries. Concordance between the suggested explanation and experimental data in the literature is given as justification for the colloidal viewpoint.

A discussion was presented on the uses of the polarizing microscope in a laboratory devoted to waterconditioning problems, discussing in a general manner the technique employed in the examination of scale deposits and corroded metal surfaces, the application of chemical microscopy for the identification of substances, and the identification of crystalline materials by the measurement of optical properties.

The paper on "Determination of Hardness in Water by Direct Titration" pointed out that hardness may be determined by a direct titration with the potassium salt of certain fatty acids. Potassium stearate and potassium palmitate are found to be of value, the palmitate allowing the more accurate determination in the presence of interfering ions. Comparisons with the standard soap method on a number of samples showed the palmitate method to be subject to less error and more extensive use of this method was suggested.

ELECTRICAL INSULATING MATERIALS; RUBBER; TEXTILES; AND SOAP

Committee D-9 on Electrical Insulating Materials recommended a number of important actions on specifications and tests in its charge. Completely revised methods of tests for insulation resistance of electrical insulating materials were approved for publication as tentative to replace when adopted the present Standard Method D 257. Extensively revised Tentative Methods of Testing Flexible Varnished Tubing Used for Electrical Insulation (D 350 - 35 T) were also approved.

Results of nine methods of determining dielectric constants of sheet materials used in making measurements on the same specimens with seven arrangements of circular electrodes were described in a paper on "Determination of the Edge Correction in the Measurement of Dielectric Constant." The author compared the various methods according to the percentage of error of the values obtained.

A new tentative method for air pressure heat test of vulcanized rubber was approved on the recommendation of Committee D-11 on Rubber Products. The short time required for securing marked deterioration of vulcanized rubber under the conditions of the test adds greatly to the convenience and utility of the method when it is necessary to obtain quickly an estimate of the relative stability of vulcanized rubber under severe conditions. Tests of this type have come into quite general use but heretofore have undergone very little standardization.

An extensive report was submitted by Committee D-13 on Textile Materials which included three new methods of test covering wool felt, certain wool and part wool fabrics, and the volumetric determination of small amounts of copper and manganese in textiles. A new standard which combines three existing specifications and tests for tire fabrics other than cotton fabrics was approved for reference to letter ballot for immediate adoption. A number of revisions of tentative methods were approved and four existing standards were recommended for adoption as standard. The definition of artificial wool which was given in the revision of the definitions of terms relating to textile materials was withdrawn by the committee.

Committee D-12 on Soaps and Detergents, which was organized a year ago, in its first annual report indicated outstanding progress made during the year. Four new tentative specifications were approved on the committee's recommendation covering milled toilet soap, caustic soda, modified soda (sesquicarbonate type) and soda ash. Methods of sampling and chemical analysis of soaps and soap products were approved and also definitions of terms relating to soaps and detergents. In appendices to the report proposed methods of chemical analysis of sulfonated (sulfated) oils and of special detergents are published for information.

Ceramic Society Glass Division Meeting

THE Glass Division of the American Ceramic Society will hold a two-day meeting at State College, Pa., on Friday and Saturday, September 10 and 11. A. N. Finn, National Bureau of Standards, chairman of the Glass Division, has announced a program which for Friday includes papers on "New Developments and Ideas in Analytical Chemistry of Interest to the Glass Industry," by G. E. F. Lundell; "Developments in the Concepts of the Constitution of Glass," by N. W. Taylor; and "A Critical Summary of the Results of X-ray Studies of Glass," by B. E. Warren. On Saturday there will be a paper by G. W. Morey and Louis Navias on "The Mechanical Properties of Glass: Their Significance and Determination." The program is designed to allow ample time for presentation and discussion of the selected topics.

Society of Rheology to Meet

THE Ninth annual meeting of the Society of Rheology will be held at the Hotel Mayflower, Akron, Ohio, October 22-23. This Society is a member society of the American Institute of Physics and is concerned with the flow of matter under stress. Specific properties studied include viscosity, plasticity, consistency, elasticity and others of like nature. These properties are of interest to a wide variety of industries.

The program of papers is now in preparation. Titles and abstracts (not more than 300 words) should be submitted to the program chairman, H. R. Lillie, Corning Glass Works, Corning, New York, not later than September 15.

NECROLOGY

We announce with regret the death of the following members:

G. HERBERT BRAZER, Civil Engineer, J. R. Worcester and Co., Boston, Mass. Member since 1906.

JOSEPH E. CHAPIN, Chief Chemist, U. S. Navy Yard, Philadelphia, Pa. Member since 1918. Mr. Chapin was a member of Committee D-11 on Rubber Products.

HARRISON P. EDDY, Consulting Engineer, Boston, Mass. Member since 1910.

PAUL EVANS GREEN, Civil Engineer, Marr, Green & Opper, Chicago, Ill. Member since 1919.

DANIEL E. RITTER, Vice-President, Lehigh Portland Cement Co., Allentown, Pa. Member since 1909.

O. C. ROHDE, Chief Engineer, Champion Spark Plug Co., Toledo, Ohio. Member since 1919.

TENG-SHAN TUNG, Manager, Materials and Testing Dept., The Government Arsenal, Taiyuanfu, Shansi, China. Member since 1928.

JOHN W. GINDER, Superintendent, Architectural Engineering, Engineering Section, Procurement Division, Public Works Branch, Treasury Dept., Washington, D. C. Mr. Ginder, who died on July 14, had been a member of the Society since 1924. He was a member of many Society committees including the following: C-1 on Cement, C-3 on Brick, C-7 on Lime, C-10 on Hollow Masonry Building Units, C-11 on Gypsum, C-18 on Natural Building Stones and Slate, D-8 on Bituminous Waterproofing and Roofing Materials and D-14 on Screen Wire Cloth.

Mr. Ginder had been chairman of Committee C-11 on Gypsum since 1926 and he was serving as vice-chairman of Committee C-10 on Hollow Masonry Building Units. A native of Massillon, Ohio, he had been a Federal employee for 36 years, during this time being in the supervising architect's office. His many associates and friends in the Society will feel his loss keenly.

Calendar of Society Meetings

(Arranged in Chronological Order)

AMERICAN CHEMICAL SOCIETY—September 6-10, Rochester, N. Y.
AMERICAN CERAMIC SOCIETY, GLASS DIVISION—September 10-11, State College, Pa.
AMERICAN TRANSIT ASSN.—Annual Convention, September 19-23, The Greenbrier Hotel, White Sulphur Springs, W. Va.
ASSOCIATION OF IRON AND STEEL ENGINEERS—September 28-October 1, Chicago, Ill.
AMERICAN SOCIETY OF MUNICIPAL ENGINEERS—October 4-6, Atlanta, Ga.
AMERICAN SOCIETY OF CIVIL ENGINEERS—Fall Meeting, October 6-8, Boston, Mass.
AMERICAN SOCIETY FOR METALS—National Metal Congress and Exposition, October 16-22, Atlantic City, N. J.
TECHNICAL ASSOCIATION OF THE PULP AND PAPER INDUSTRY—Fall Convention, October 18-20, De Sota Hotel, Savannah, Ga.
AMERICAN WELDING SOCIETY—October 18-21, Atlantic City, N. J.
SOCIETY OF RHEOLOGY—October 22-23, Akron, Ohio.
AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS—Annual Meeting, December 3 and 4, Bellevue-Stratford, Philadelphia, Pa.
AMERICAN SOCIETY OF MECHANICAL ENGINEERS—Annual Meeting, December 6-10, New York City.
AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE—December 29-31, Indianapolis, Ind.
AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS—Winter Convention, January 24-28, New York City.
AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS—January 24-28, Grand Central Palace, New York City.
AMERICAN CERAMIC SOCIETY—April 4-7, New Orleans, La.

More Standards Approved By A. S. A.

QUITE a number of A.S.T.M. specifications have been approved by the American Standards Association within recent months, as will be noted from the following list, and one American tentative standard—the Specifications for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Ordinary Uses (A.S.T.M. A 120 - 36: A.S.A. g 8.7 - 1937)—has been advanced to the status of American standard.

SPECIFICATIONS FOR:	DESIGNATION	
	A.S.T.M.	A.S.A.
Uncoated Wrought-Iron Sheets	A 162 – 36	G23 – 1937
Zinc-Coated (Galvanized) Wrought Iron Sheets	A 163 – 36	G8.8 – 1937
Bronze Trolley Wire	B 9 – 36	H22.1 – 1937
Copper Trolley Wire	B 47 – 36	H22.2 – 1937
Zinc Oxide	D 79 – 24	K22 – 1937
Basic Carbonate White Lead	D 81 – 34	K23 – 1937
Red Lead	D 83 – 31	K24 – 1937
Mineral Iron Oxide	D 84 – 27	K25 – 1937
Lampblack	D 209 – 30	K26 – 1937
Chrome Yellow	D 211 – 27	K27 – 1937
Reduced Chrome Green	D 213 – 27	K28 – 1937
Prussian Blue	D 261 – 28	K29 – 1937
Ultramarine Blue	D 262 – 28	K30 – 1937
Commercial Para Red	D 264 – 28	K31 – 1937

The total number of A.S.T.M. specifications and methods of test which have been approved by the A.S.A. is now 130.

SOCIETY APPOINTMENTS

Announcement is made of the following Society appointments:

H. H. MORGAN, Robert W. Hunt Co., as the representative of the Society on the Sectional Committee on Building Code Requirements for Iron and Steel under A.S.A. procedure.

J. A. CAPP, General Electric Co., has been reappointed as one of the Society's representatives on the Standards Council of A.S.A. for a term of three years.

W. H. FINKELDEY, Singmaster and Breyer, as the representative of the Society on the Non-Ferrous Metallurgical Advisory Committee to the National Bureau of Standards.

NEW MEMBERS TO JULY 16, 1937

The following 112 members were elected from April 22 to July 16, 1937:

Company Members (19)

AMERICAN INSULATOR CORP., B. H. Bowlus, Development Engineer, New Freedom, Pa.

AUSTIN CO., THE, A. S. Low, Vice-President and Chief Engineer, 16112 Euclid Ave., Cleveland, Ohio.

CHENEY BROS., H. B. Benson, Inspection Superintendent, South Manchester, Conn.

CLAY PRODUCTS INST., C. T. Bridgman, Engineer, 710 Hubbell Building, Des Moines, Iowa.

COOPERATIVE G.L.F. FARM SUPPLIES, INC., J. W. Crofoot, Quality Control, Ithaca, N. Y.

COWLES DETERGENT CO., THE, F. H. Guernsey, Chemical Director, 10525 Carnegie Ave., Cleveland, Ohio.

EDGCOMB STEEL CO., C. S. Vogel, Welding Engineer, D St. below Erie Ave., Philadelphia, Pa.

GOODYEAR YELLOW PINE CO., I. E. Knapp, Chief Chemist, Picayune, Miss.

JERSEY TESTING LABS., G. J. Wingerter, 154-156 Wright St., Newark, N. J.

KEN-RAD TUBE AND LAMP CORP., G. F. Callahan, Assistant Chief Engineer, Ninth and Mosley Sts., Owensboro, Ky.

KEYSTONE VARNISH CO., C. G. Oswald, Chief Chemist, 71 Otsego St., Brooklyn, N. Y.

MALLORY, P. R., INC., B. V. K. French, Application Engineer, East Washington St., Indianapolis, Ind.

MARKS AND SPENCER, LTD., E. Kann, Manager, Research Dept., 82 Baker St., London, W. 1, England.

MICHIGAN MALLEABLE IRON CO., H. M. Wright, Metallurgist, 7740 Gould, Detroit, Mich.

NATIONAL UNION RADIO CORP., M. N. Fredenburgh, Chief Chemist, 57-59 State St., Newark, N. J.

SERVICISED PRODUCTS CORP., W. C. Fischer, Vice-President, 6051 W. Sixty-fifth St., Chicago, Ill.

SWAN-FINCH OIL CORP., J. H. Krestan, Superintendent of Chicago Plant, 1605 RCA Building West, 30 Rockefeller Plaza, New York City.

TENNESSEE EASTMAN CORP., C. H. Penning, Tenite Sales, Kingsport, Tenn.

WALKER CO., H. V., A. O. Plambeck, Technical Director, P. O. Box 273, Elizabeth, N. J.

Individual and Other Members (89)

ALLISON, F. G., State Highway Board of Georgia, Division of Tests, 2 Capitol Square, Atlanta, Ga.

ANDERS, S. F., Metallurgist, Republic Steel Corp., Gulf Steel Division, Gadsden, Ala. For mail: 924 Forrest Ave., Gadsden, Ala.

ARNOLD, W. P., Technical Director, The Wood Preserving Corp., Orrville, Ohio.

AKRON, CITY OF, DIVISION OF HIGHWAYS, G. Soderberg, Highway Engineer, 602 Municipal Building, Akron, Ohio.

BARBER, ERNEST, Textile Expert and Consultant, 150 Graham Ave., Paterson, N. J.

BARKER, C. L., District Manager, Robert W. Hunt Co., Ensley, Ala. For mail: 1 Nineteenth St., Ensley, Ala.

BARTOE, W. F., Physicist, Röhm & Haas Co., Bristol, Pa.

BOYD, J. E., Sales Engineer, Weston & Brooker Co., 1314 Rhodes Haverty Building, Atlanta, Ga.

BRIGGS, T. H., Engineer, Raytheon Production Corp., 55 Chapel St., Newton, Mass.

BROWN, K. R., Director, Research Laboratory, Atlas Powder Co., Tamaqua, Pa.

BROWN, W. D., Chief Chemist, Carnegie-Illinois Steel Corp., Duquesne, Pa.

BUCKMAN, S. J., American Creosoting Co., 401 W. Main St., Louisville, Ky.

BUSHNELL, S. W., Chief Engineer, Automotive Engineering Co., 2224 First Ave., South, Seattle, Wash.

CHAMBERLAIN, H. L., Metallurgical Engineer, Research Dept., Tube Investments, Ltd., Wheelwright Road, Erdington, Birmingham, England.

COLORADO STATE HIGHWAY DEPT., K. C. Vail, Materials Engineer, 1370 Krameria St., Denver, Colo.

CORSON, B. L., Vice-President and Treasurer, G. & W. H. Corson, Inc., Plymouth Meeting, Pa.

COVERT, A. D., President, Plastic Products Co., 6475 Georgia, Detroit, Mich.

COX, M. E., Engineer, Sam E. Finley, 292 North Ave., Atlanta, Ga.

DAUGHERTY, T. H., Research Chemist, Hall Laboratories, Inc., 304 Ross St., Pittsburgh, Pa. For mail: 222 Catskill Ave., Brentwood, Pittsburgh, Pa.

DEMIRJIAN, N. M., In Charge of Methods Control, Revere Copper and Brass, Incorporated, 24 N. Front St., New Bedford, Mass.

DENT, G. H., Acting Materials Engineer, States Roads Commission, Federal Reserve Bank Building, Baltimore, Md.

FLINT, CITY OF, DIVISION OF PUBLIC WORKS, City Hall, Flint, Mich.

FOCKE, A. E., Research Metallurgist, Diamond Chain and Mfg. Co., 502 Kentucky Ave., Indianapolis, Ind. For mail: 5262 Kenwood Ave., Indianapolis, Ind.

FRIESELL, C. E., Assistant Professor, School of Dentistry, University of Pittsburgh, Pittsburgh, Pa.

GABLE, R. H., President, Superior Tube Co., Box 227, Norristown, Pa.

GANGHOFER, DR., Siemens-Schuckertwerke A.G., Zentral-Werksverwaltung, Berlin-Siemensstadt, Germany.

GOLLOMB, HENRY, Chemist in Charge, Testing Laboratory, Bureau of Sewers and Highways, President of the Borough of Manhattan, Municipal Building, New York City. For mail: 110 W. Sixty-ninth St., New York City.

GONDER, J. M., Laboratory Director, The Koppers Coal Co., 1330 Locust St., Pittsburgh, Pa.

GOODKIND, MORRIS, Bridge Engineer, State Highway Dept., State House Annex, Trenton, N. J.

GROVE, CLINTON, United Color and Pigment Co., Technical Service Division, Newark, N. J.

GWIN, L. L., Office Engineer, Hunter & Caldwell, 3601 Fifth Ave., Altoona, Pa. For mail: 106 Aldrich Ave., Altoona, Pa.

HERSEY, M. D., Engineer, Kingsbury Machine Works, Inc., 4320 Tackawanna St., Philadelphia, Pa.

KELTON, E. H., Chief Research Director, New Jersey Zinc Co., Palmerton, Pa. For mail: 244 Princeton Ave., Palmerton, Pa.

KIERNAN, W. P., Chemical Engineer, Callite Products Co., 540 Thirty-ninth St., Union City, N. J.

KLEIN, C. H., Development Engineer, The National Telephone Supply Co., 5100 Superior Ave., Cleveland, Ohio.

KLINE, G. M., Chief, Organic Plastics Section, National Bureau of Standards, Washington, D. C. For mail: 109 Battery Lane, Bethesda, Md.

LANDSELL, H. C., Assistant Manager, Hubbard and Co., 5401 W. Roosevelt Road, Cicero, Ill.

LINDOW, C. W., Director of Research, Research Laboratories, Kellogg Co., Porter and Stiles Sts., Battle Creek, Mich.

LITTLE, N. O., Assistant to Manager, Metallurgical Dept., Carnegie-Illinois Steel Corp., 208 S. La Salle St., Chicago, Ill.

LURIE, JACOB, Chief Chemist, Lacquer Division, The Fiberoid Corp., Indian Orchard, Mass. For mail: 61 Kimberly Ave., Springfield, Mass.

LYNN, C. L., Chemical Engineer, 2 S. Clinton Ave., Trenton, N. J.

MATLACK, R. W., Technical Director, Geo. D. Wetherill & Co., Inc., 113 Arch St., Philadelphia, Pa.

MCCABE, J. H., East Coast Manager, E. W. Saybolt and Co., 140 Cedar St., New York City.

MCCREADY, D. W., University of Michigan, 2028 East Engineering Building, Ann Arbor, Mich.

MCCRONE, R. M., Civil Engineer, U. S. Engineers, Gulf of Mexico Division, War Dept., 412 Masonic Temple, New Orleans, La.

MCGINNIS, F. S., Chemist, Kentucky Rock Asphalt Co., Bowling Green, Ky. For mail: 103 W. Fourteenth St., Bowling Green, Ky.

MEYER, L. W. A., Tennessee Eastman Corp., Kingsport, Tenn.

MOREY, G. W., Geophysical Laboratory, Carnegie Institute of Washington, 2801 Upton St., N. W., Washington, D. C.

NEWMAN, ROCKWELL, President, The Newman Co., 407 S. Jefferson St., Orange, N. J.

NEW ZEALAND STANDARD INST., Museum St., Wellington, New Zealand.

OAKLAND COUNTY ROAD COMMISSION, J. H. Barr, Assistant Engineer, 550 Telegraph Road, Pontiac, Mich.

OPPER, G. L., President, Marr, Green & Opper, 400 N. Michigan Ave., Chicago, Ill.

ORR, C. P., Banner Oil Co., 1300 Pine St., Camden, N. J.

OWEN, J. T., Chief Chemist, Tung Sol Lamp Works, Inc., 370 Orange St., Newark, N. J.

PAINE, H. W., Chemical Director, E. I. du Pont de Nemours and Co., Inc., Plastics Dept., 626 Schuyler Ave., Arlington, N. J.

PALMER, S. T., Research Engineer, Asbestos Manufacturing Co., Huntington, Ind.

PARKS, J. R., Laboratory Director, Weatherhead Co., 300 E. 131st St., Cleveland, Ohio.

PERRINE, HAROLD, Chief Engineer, Owens-Illinois Glass Co., Ohio Building, Toledo, Ohio.

PETERS, A. T., Metallurgist, Smith Steel Foundry Co., 1320 S. First St., Milwaukee, Wis.

PFAHLER, R. G., Mining Engineer, The Berwind-White Coal Mining Co., Windber, Pa.

PLUMMER, H. C., Chief Engineer, Structural Clay Products, Inc., 1427 Eye St., N. W., Washington, D. C.

PRICE, S. G., Vice-President, The Gibsonburg Lime Products Co., Gibsonburg, Ohio.

QUIMBY, G. F., Secretary-Treasurer, Soft Fibre Manufacturers' Inst., Suite 1721, 9 Rockefeller Plaza, New York City.

RAPP, G. M., Assistant Engineer, The Port of New York Authority, New York City. For mail: 75 Gordonhurst Ave., Upper Montclair, N. J.

REICHENBACH, H. A., General Superintendent, Nazareth Cement Co., Nazareth, Pa. For mail: 643 Highland Ave., Bethlehem, Pa.

ROHL, L. J., Assistant Manager, Metallurgical Dept., Carnegie-Illinois Steel Corp., 208 S. La Salle St., Chicago, Ill.

RUHE, CARL, Chief Chemist, Homestead Steel Works, Munhall, Pa.

SAUNDERS, S. G., Staff Officer, Dodge Brothers Corp., 7900 Joseph Campau Ave., Detroit, Mich.

SAWYER, J. S., Manager, Asphalt Dept., Shell Union Oil Corp., 50 W. Fiftieth St., New York City.

SCHERF, FRED, Wilshire Oil Co., Inc., 2455 E. Twenty-seventh St., Los Angeles, Calif.

SHANGHAI, CITY OF, PUBLIC WORKS DEPT., MUNICIPAL COUNCIL, The Commissioner, Shanghai, China.

SOLL, R. H., Metallurgist, Emsco Derrick and Equipment Co., 6811 S. Alameda St., Los Angeles, Calif.

SOMERS, J. G., Assistant Secretary, Somers Brass Co., Inc., Waterbury, Conn.

SPEICHER, C. S., Vice-President, Somers Brass Co., Inc., Waterbury, Conn. For mail: 519 Almena Ave., Ardsley, N. Y.

STANLEY, H. A., Plant Engineer, Berkshire Fine Spinning Associates, Inc., Providence, R. I.

STAPLES, J. P., General Manager, Pittsburgh Corning Corp., Grant Building, Pittsburgh, Pa.

STEVENS, J. B., Secretary, Charles G. Stevens Co., 564 W. Monroe St., Chicago, Ill.

STEWART, ALEXANDER, Chemist, National Lead Co., 105 York St., Brooklyn, N. Y.

STREBLOW, A. G., President, Basalt Rock Co., Inc., Eighth and River Sts., Napa, Calif.

SUGAR, ALFRED, Metallurgist, U. S. Reduction Co., East Chicago, Ind. For mail: 5343 Cornell Ave., Chicago, Ill.

SUMMERSBY, G. W., President, Bradford Dyeing Assn. (U.S.A.), Box 539, Westerly, R. I.

TABER, R. F., President and General Manager, Taber Instrument Co., North Tonawanda, N. Y. For mail: 257 Goundry St., North Tonawanda, N. Y.

TILLOTSON, E. W., Assistant Director, Mellon Institute of Industrial Research, Pittsburgh, Pa.

UNIVERSITY OF ALABAMA, Henrietta M. Thompson, Head, Department of Clothing and Textiles, University, Ala.

WEBER, T. R., Mechanical Engineer, American Locomotive Co., Latrobe, Pa.

WEIR, PAUL, Consulting Engineer, 307 N. Michigan Ave., Chicago, Ill.

WILKINS, F. C., Engineer of Tests, Otis Steel Co., Cleveland, Ohio.

WILLIAMS, I. V., Member of Technical Staff, Bell Telephone Laboratories, 463 West St., New York City.

WORSHAM, W. B., Assistant Engineer of Materials, Illinois Division of Highways, Bureau of Materials, Springfield, Ill. For mail: 1912 S. Fifth St., Springfield, Ill.

Junior Members (4)

FRITTS, S. S., Physical Chemist, Edison Cement Corp., Stewartsville, N. J. For mail: 127 Bullman St., Phillipsburg, N. J.

HENNING, GEORGE, JR., Vice-President, Belmont Smelting and Refining Works, Inc., 330 Belmont Ave., Brooklyn, N. Y.

MARTIN, C. B., Testing Engineer, American Car and Foundry Co., Berwick, Pa. For mail: 120 E. Fifteenth St., Berwick, Pa.

STITELER, C. H., Chemist, Flori Mothproofing Method. Inc., 252 S. Broad St., Philadelphia, Pa.

PERSONALS

* * * News items concerning the activities of our members will be welcomed for inclusion in this column.

GUSTAF PETERSON, formerly District Manager of Sales, Ludlum Steel Co., Philadelphia, is now Manager, Tool Steel Dept., Edgcomb Steel Co., Philadelphia.

G. N. KROUSE is now Mechanical Engineer, Krouse Fatigue Machine Co., Columbus, Ohio. He was formerly connected with the Aluminum Company of America as Mechanical Engineer.

FFORD BURCHFELL is now Assistant Treasurer, Industrial Developments, Inc., New York City.

F. P. DAHLSTROM, who was Mechanical Engineer, Thompson Wire Co., is now Electrical Engineer, The Aetna Standard Engineering Co., Youngstown, Ohio.

M. B. MOORE is Development Engineer, The Linde Air Products Co., Newark, N. J.

H. A. PFEIFER is Sales Engineer, Bisbes Linseed Co., Philadelphia, Pa.

L. P. SAVARIE is Fabric Technologist, United States Testing Co., Inc., Hoboken, N. J. He was Textile Technologist, Utica and Mohawk Cotton Mills.

R. W. BOYD, formerly Engineer, Turner Construction Co., is now connected with the New York State Employment Service, New York City.

R. W. VOSE, who was Instructor in Materials Testing and Photoelasticity, Massachusetts Institute of Technology, has been appointed Instructor in Charge, Materials Laboratory, Harvard University, Cambridge, Mass.

LYMAN BILLINGS, formerly Chief Chemist, Stillwater Worsted Mills, is now Salesman, Lubricating Division, Socony-Vacuum Oil Co., Inc., Boston, Mass.

G. F. JENKS, who was Commanding Officer, Watertown Arsenal, is now Chief of Technical Staff, Office of Chief of Ordnance, U. S. Army, Washington, D. C.

G. B. WATERHOUSE, Professor of Metallurgy, Massachusetts Institute of Technology, was recently elected to the board of directors, Dominion Steel and Coal Corp., Montreal, Que.

H. S. BRIGHTLY is the Director of the Limestone Institute's Technical and Field Service Division. This Division was formerly the Building Stone Association of Indiana of which Mr. Brightly was the Secretary-Director.

W. R. FULLER has resigned as Technical Director, Pratt & Lambert, Inc., Buffalo, to become Manager of Industrial Research for Devoe & Raynolds Co, Inc., Louisville, Ky.

BRADLEY DEWEY, President, Dewey & Almy Chemical Co., has been elected a life member of the governing board of Massachusetts Institute of Technology.

ANSON MARSTON, Senior Dean of Engineering, Iowa State College, was awarded an Honorary Membership in the Iowa Engineering Society at the recent annual meeting of this society. T. R. AGG, Dean of Engineering, College of Engineering, Iowa State College, was elected president of the society for the forthcoming year.

F. L. PLUMMER, Professor of Structural Engineering, Case School of Applied Science was recently elected president of the Cleveland Engineering Society.

GUSTAV EGLOFF, Technical Director, Universal Oil Products Co., officiated as vice-president of the recent Second World Petroleum Congress held in Paris, France.

At the Medal Meeting of The Franklin Institute held in May, several A.S.T.M. members were awarded medals: H. L. WHITTEMORE, Chief, Engineering Mechanics Section, National Bureau of Standards, received the Longstreth Medal; INGE LYSE, Research Professor of Engineering Materials, Lehigh University, was presented with the Levy Medal; and J. C. HOSTETTER, Vice-President, in charge of Research and Development, Hartford-Empire Co., received the Potts Medal.

T. SMITH TAYLOR, formerly Professor of Physics, Thistle Physical Lab., Washington & Jefferson College, is Now Manager, Engineering Laboratory and Experimental Dept., Diehl Manufacturing Co., Elizabethport, N. J.

W. H. ATKINSON is connected with the Owens-Illinois Glass Co., Industrial and Structural Products Div., as Sales Engineer. He was formerly Chemical Engineer, Asbestos Manufacturing Co., Huntington, Ind.

But He Forgot

He brushed his teeth twice a day with a nationally advertised tooth brush.
The doctor examined him twice a year.
He wore rubbers when it rained.
He slept with the windows open.
He stuck to a diet with plenty of fresh vegetables.
He relinquished his tonsils and traded in several worn-out glands.
He golfed, but never more than eighteen holes.
He never smoked, drank or lost his temper.
He did his daily-dozen daily.
He got at least eight hours' sleep each night.
His funeral will be held next Wednesday.
He is survived by eighteen specialists, four health institutes, six gymnasiums and numerous manufacturers of health foods and antiseptics.
He had forgotten about trains at grade crossings.

Traffic Tidings